THE
TROPICAL AGRICULTURIST:
JOURNAL OF THE
CEYLON AGRICULTURAL SOCIETY.

VOL. XLII. COLOMBO, JUNE, 1914. **No. 6.**

CO-OPERATIVE CREDIT.

Peradeniya, June, 1914.

The Conference of Co-operative Credit Societies which was held at the King's Pavilion, Kandy, on April 28th, under the patronage of His Excellency the Governor, will no doubt be considered the most important event of the year as far as the progress of agriculture is concerned. For many years, the benefits and advantages to be derived from co-operation were persistently brought to the notice of the Ceylon public, and this continual advocacy, assisted in great measure by the success of the movement in India, finally bore fruit in the passing of the Co-operative Credit Societies Ordinance of 1911.

That Ordinance has not been allowed to remain a dead letter. Thanks to the vigorous propaganda carried on by the officers of the Agricultural Society, and the enthusiastic support of the Mudaliyars and other officials who are most closely in touch with the agriculturist, a highly satisfactory beginning has been made. That enthusiasm was also evidenced by the large attendance, at the Conference, of delegates and others interested in the Co-operative Credit movement from all parts of the Island, in many cases at great personal inconvenience.

To His Excellency the Governor the Conference was indebted for a new light on co-operation in Ceylon which should help to remove any reluctance on the part of the agriculturist to

participate. His Excellency emphasised the fact that co-operation in the operations of agriculture is an established custom in the Island, to a degree unknown in temperate countries, if indeed it can be said to exist at all in such. But hitherto such co-operation has not been extended to monetary transactions. The realization of this will, it is hoped, facilitate the adoption of Co-operative Credit by those who are most in need of it.

The Ceylon Ordinance is based to a great extent on the corresponding Act which has been found to work with such success in India. Modifications will no doubt be necessary from time to time, but for the present we have a solid foundation to work from. The resolutions adopted by the Conference were eminently practical, and demonstrated the active interest taken by the members in the management of their Societies.

It must not be forgotten that Co-operative Credit is not necessarily confined to Agriculture. The opportunities for its application in other industries are equally numerous. It is perhaps more difficult to establish co-operation for credit among small artisans, as each member of a trade is inclined to regard another as a rival ; but societies of weavers, shoemakers, dairymen, etc., have been successfully established in India. Many large firms have instituted Co-operative Credit Societies among their employees.

The co-operative spirit already exists among the village agriculturists, but it needs to be organised and directed along proper channels, so that the village may grasp the idea that it is a corporate community and that its members must, if they are to advance, work together for the common good. The extent to which this will be realised depends on the self-sacrificing efforts of the pioneers of the movement, and it is gratifying to be able to record that there is abundant evidence that such efforts have been, and are being, made. We may be permitted to express the hope that during the current year many others will be found willing to assist in the furtherance of the movement.

T. P.

RUBBER.

THE DESTRUCTION OF RUBBER BY MICROBES.

The occurrence of red, yellow, brown, purple, or black spots in sheet and crepe rubber is a well-known phenomenon, and it is now recognised that these are, in general, caused by fungi and bacteria. It is also claimed by some that these discoloured spots are the forerunners of tackiness, though no evidence of that has been adduced and the experience of all observers would appear to be to the contrary. All experimental evidence hitherto obtained points to oxidation as the cause of tackiness, though why particular batches of rubber should take up oxygen is as yet unexplained. The bacterial theory of tackiness has however fallen into disrepute, chiefly because, as has been known for at least fifteen years, exposure to sunlight, which is inimical to the development of bacteria, favours the development of tackiness.

It has been generally believed that the growth of fungi and bacteria on crude rubber could not injure the actual caoutchouc, because no organism was known which could attack and derive nourishment from that substance. The organisms found in crude rubber were supposed to live on the sugars and proteids in the rubber, not on the rubber itself.

MESSRS. N. L. SÖHNGEN and J. G. FOL have recently carried out experiments on this subject in Europe. They failed to cultivate the fungi which occur in rubber : it is generally found impossible to do that once the rubber has become dry, and in the case of some organisms, e.g. *Bacillus prodigiosus*, it would seem that the bacterium lives on the surface and only the colouring substance penetrates. But they have nevertheless made some important additions to our knowledge.

The coloured spots were cut out of a piece of crepe, and compared with the unspotted part. On analysis, no difference was found between the ash of the coloured and that of the uncoloured part. Samples of both were then dissolved, and the viscosity of each determined. The viscosity curves of the two were identical, showing that no destruction of the caoutchouc had occurred as a result of the development of the spots. The authors conclude that the spots make no difference to the actual value of the rubber.

In further experiments the authors prepared thin sheets of rubber as free as possible from proteids by the method of CLAYTON BEADLE AND STEVENS. In that way they obtained sheets containing about 0·1 per cent. of nitrogenous compounds. These sheets were placed in glass dishes and moistened with a solution containing inorganic salts only, thus forming a culture medium in which the only source of carbon (apart from impurities) was the caoutchouc. They were then infected with ordinary garden soil, with the result that two fungi, *Actinomyces elastica* and *Actinomyces fuscus*, developed on the rubber films.

It was found that owing to the growth of these fungi on the films the rubber became friable and could easily be broken up, and on the spots where the colonies of the fungi had grown holes occurred in the film. Viscosity experiments proved that the viscosity of the infected rubber was decreased.

The authors consider that their experiments prove the existence of fungi which can attack and feed on caoutchouc. There are however several possibilities of error in the methods employed, and confirmation will no doubt be required before their findings are accepted. Curiously enough, both the fungi in question are remarkably deficient in enzymes.

T. PETCH.

RUBBER TESTING MACHINERY AT THE IMPERIAL INSTITUTE.

The methods adopted for the preparation of plantation Para rubber have given rise to considerable discussion among agricultural officers and planters in the East, and a number of proposals have been made with the view of raising the average quality of the rubber in comparison with fine hard Para, and of securing greater uniformity in different consignments. In this connection, however, it has been felt that the present methods of judging the quality of rubber in the sale room are exceedingly crude and unsatisfactory, and that the only way to secure accurate data for comparison would be to carry out a careful scientific investigation of series of samples of plantation Para rubber prepared in different ways.

There can be no doubt that the best and most trustworthy method of judging the quality of a sample of rubber is to vulcanise a portion and to submit the vulcanised product to mechanical tests, as by this means the behaviour of the rubber under manufacturing conditions can be studied and its technical quality and value determined. Some work on these lines has already been carried out, but much further investigation is required before the question of the best method of preparation for use on plantations can be solved. Recognising this fact, the Rubber Research Committee of Ceylon, in co-operation with the Department of Agriculture in the Colony, has arranged with the Imperial Institute to conduct a complete investigation of the whole question of the effect of different methods of preparation on the quality of the rubber, and this work is now in progress. A scheme of operations has been drawn up which includes the preparation in Ceylon of samples of rubber in different ways and under different conditions, care being taken that the individual factors are studied singly, and that specimens of rubber for comparison are prepared from the same sample of bulked latex. The rubbers thus obtained are to be submitted to vulcanisation and mechanical tests, and for this purpose there has been installed at the Imperial Institute a complete experimental vulcanising testing plant, a short description of which may be of general interest.

The plant required for the vulcanisation experiments, consisting of a washing machine, a mixing machine, a three-bowl calender, a vulcanising press, a vulcanising pan, a vacuum drier, and a gas-fired boiler, has been

supplied and erected by MESSRS. DAVID BRIDGE & CO., of Castleton, Manchester, the well-known rubber machinists, and embodies all the improvements which have suggested themselves to the firm as the result of their experience of the working of previous installations of the same kind. One of the large rooms in the basement of the Imperial Institute has been specially allocated for the reception of the machines and forms a completely equipped research laboratory for the mechanical testing of rubber. The chemical investigation of rubbers will be conducted, as heretofore, in the main laboratories of the Scientific and Technical Department.

The washing machine is fitted with diamond-cut chilled cast iron rollers, 4½ in. in diameter and 9 in. long, the front roller being adjustable by means of a worm and worm wheel adjustment gear ; it is supplied with hot and cold water for washing purposes.

The mixing machine has accurately turned, ground, and polished rollers, of the same size as those of the washer and adjustable by the same means. The rollers are hollowed and are fitted with water and steam connections so that they can be used either hot or cold.

The calender is fitted with three rollers similar to those of the mixer and adjustable by means of worm and worm wheel adjustment gear ; it is provided with special cut gear and clutches so that the three rollers can be run at equal speeds or a friction speed obtained between the adjacent rollers, the changes being obtained by a simple movement of the clutches. The rollers can be either steam-heated or water-cooled.

These three machines are driven by electric motors through line shafting and cut gear ; each machine being fitted with a Heywood and Bridge patent friction clutch.

The screw vulcanising press is furnished with three steam-heated platens, 12 in. square, which are machined and polished on the working faces. Each platen is provided with separate steam and drainage connections and thermometer.

The vulcanising pan, which is 18 in. deep and 18 in. in diameter, is so arranged that vulcanisation can be conducted either in live steam (by injecting steam into the pan) or in dry heat (by allowing the steam to enter only the jacket of the pan). It is fitted with the necessary steam and drainage connections, steam gauge, and thermometer.

The vacuum drier is one of BRIDGE'S improved patent vacuum drying installations, of suitable size for experimental purposes ; it is provided with steam-heated platens, condenser, receiver, and vacuum pump, the latter being driven by belts and pulleys from an electric motor.

The steam required for the working of the plant is supplied by means of a small vertical gas-fired boiler.

For the determination of the mechanical properties of vulcanised rubber, it is generally recognised that the machine designed by HERR LOUIS SCHOPPER is one of the most efficient and satisfactory, and a machine of this type, with the latest improvements, has been obtained for testing purposes. The test pieces for use with this machine are cut from vulcanised sheet in the form of rings of standard dimensions by means of a series of circular cutting knives, and these rings are evenly rotated during the application of tension. The machine can be used to determine the breaking strain and the

elongation at the breaking point ; the elongation with fixed load ; the load required for fixed elongation, etc. The machine is also fitted with an automatic apparatus for drawing hysteresis diagrams. The permanent or sub-permanent set of rubber after tension will be determined by means of a special apparatus, and other testing machines will be added during the progress of the investigation.

It is anticipated that work on these lines, carefully and systematically conducted, will throw considerable light on the effect of different methods of preparation on the quality of the rubber, and will enable a method to be selected for use on plantations which will produce rubber of the highest possible quality for manufacturing purposes.—IMPERIAL INSTITUTE BULLETIN.

WHAT THE RUBBER CHEMISTS ARE DOING.

In the "GUMMI ZEITUNG," vol. 28, page 747, E. FICKENDEY contributes an article "On the Effect of Scraping the *Manihot* Tree on the Yield of Rubber Obtained." In this article attention is called to the German patent No. 265,937 issued to the Government of Cameroon for a process for increasing the yield of latex of the *Hevea brasiliensis*. The process consists in scraping, prior to tapping, the external portions of the bark as far as the green cork cambium. This scraping is repeated at definite periods of time during the tapping season. Trees so scraped nearly always yielded twice the normal output of rubber and in some cases four times the amount.

In the case of *Kickxia*, it was found that this scraping had no effect on the yield of latex, and it is suggested that this fact is probably connected with the observation that the *Kickxia* tree does not exhibit what is known as wound reflex. It was therefore of interest to determine whether a tree such as the *Manihot*, which does exhibit the property of wound reflex, would be affected by this scraping of the bark. It was actually found that this scraping process did materially increase the yield of latex in the case of the *Manihot*, although the increase was not quite so marked as in the case of the *Hevea*.

In the "JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY," Vol. XXXII, page 1,041, W. A. CASPARI contributes an article on the "Composite Nature of Raw India Rubber." Attention has been called by previous investigators to the fact that crude rubber is not completely soluble in the usual solvents and that it consists of a soluble and an insoluble portion. CASPARI found that by using petroleum ether, B.P. 40 to 65 degs. C., a very satisfactory separation of the component parts of the rubber could be effected. By means of this solvent it is possible to obtain two distinct bodies, which may be described as soluble and insoluble rubber. The soluble portion is a colloid of relatively slight mechanical strength and has a pronounced tendency to become soft and sticky, especially on the application of heat. With solvents it forms a transparent solution and does not swell very materially prior to solution. The insoluble pectous portion

is a colloid of considerable elasticity, with a tendency to retain its structure in the presence of solvents, subsequently swelling to a "jel," usually with increase in volume. Both portions are doubtless constituted of the same hydrocarbon and have about the same specific gravity. The author constructed an apparatus for determining quantitatively the amounts of these two constituent parts of the rubber and gives the results of the determinations carried out with a variety of crude rubbers.—INDIAN RUBBER WORLD.

HEVEA IN COCHIN CHINA.

A general account of the methods adopted in the exploitation of *Hevea brasiliensis* in Cochin China, by M. GIRARD, President of the Chamber of Agriculture, appears in the "Bulletin Economique de l'Indochina" for January-February of this year.

The region in which Hevea is planted experiences a dry season extending over five or six months of the year. The author claims that owing to depth and richness of the soil this does not affect the growth of the trees, which in many cases is superior to the average of countries with a greater rainfall.

Contrary to the experience of other countries, the dry season is very favourable to the yield of rubber, the dry months of November, December and January being those in which the highest yields are obtained. The yield in December is greater by 30 per cent. than that of November, while the January yield is 50 per cent. greater than the average yield of the rainy months.

The new foliage and flowers appear in February and March, and in those months the trees are rested. Tapping begins in April, and the yield, which is small at the commencement, increases until June, after which it remains almost constant, except for a slight increase during short periods of dry weather, until October or November, according to the duration of the rains. Then it rises as already stated.

It will be seen that, in spite of differences in climate, the annual history of the trees is similar to that of the trees on the western side of Ceylon. It would appear therefore that, as far as regards the yield, the result noted is not due to the dry season in Cochin China, nor to the wet season in Ceylon, but, as has been previously advanced, is in some way dependent upon the annual periodic changes in the tree. Apparently the greatest yield is obtained when the tree is approaching the end of its annual period of growth. It would be interesting to know whether the same is true of trees which, growing in the same district, "winter" at widely different times of the year.

Tapping is carried on in Cochin China for about three hundred days in the year. For the first 180 or 200 days, the yield is said to be the same as in the F.M.S. for trees of the same age, but, according to this author, it becomes greater for the last 100 or 120 days, in the dry season. Actual yields are not given.

THE DAILY TASK.

The Annamite tapper is said to be a quicker and more skilful worker than any in other countries.

The daily task was at first 125 trees. This was afterwards increased to 300 trees, and then to 400. This figure is said to have been obtained for all the tappers, in less than a year.

The tapper has to make three cuts on each of 400 trees. His work included watering the cuts, collecting the latex, washing the cups, transport of latex and washings to the factory, and the cleansing of all his utensils. This was accomplished between half past five and half past eleven. In the afternoon, from three to six, the same workers collected scrap.

Watering the cuts necessitated two extra visits to each tree, and did not appear to be necessary. This was accordingly abandoned, and in consequence, the daily task was raised to 600 trees per man. The women, who tapped 300 trees a day when the cuts were watered, tapped 450 when watering was discarded.

Tapping was done on one-fifth of the circumference, half herring bone, with three cuts, eighteen inches apart, at an angle of 15°. The trees are tapped daily, twenty-five cuts to the inch. The author recommends those who are just beginning to tap to employ the same system, on one-sixth of the circumference with the cuts at an angle of 45°.

T. PETCH.

WICKHAM HARD CURE.

More trouble seems in store for Brazilian finances—that is supposing that the Wickham Hard Cure Process comes up to the confident anticipations of the promoters of the company which is now engaged in exploiting it. I have not been fortunate enough yet to obtain a sample of the smoked rubber, but from what I have heard there is not exactly a unanimous opinion among manufacturers as to the equality of this rubber with Brazilian Hard Cure. Moreover the suggestion has been made in certain quarters that MR. WICKHAM, who is universally respected, has lent his name and influence rather too readily to the city element. Presumably the patent is a sound one, though, as the treatment of rubber latex with wood smoke is of course well known, the novelty must lie in the particular mechanical contrivance for carrying it into effect.

Briefly described the Wickham machine consists of a vertical disc with a flange three or four inches wide, the liquid latex being allowed to drip on the interior of the flange at a uniform rate. The disc is revolved at about 90 revolutions per minute, the centrifugal action causing the latex to spread, and carrying it in a thin film round the interior of the flange, to where a jet of hot smoke is allowed to impinge upon it. The resulting effect is a continuous process of curing in the Amazonian fashion, superimposed thin films of rubber being formed. When a thick enough film has been formed it is removed and pressed for transport. *Prima facie*, this process, which is quite distinct from the Byrne patent process of smoking the already coagulated latex, should give rubber equal to the Brazilian—always supposing that the actual composition of the latex from the youthful eastern trees is identical with that yielded by trees of far greater age. Personally I am not at all

satisfied that the latices are similar, and if they are not I imagine that it is asking far too much of the creosote in the smoke to rectify the deficiency in the plantation output. As samples of the Wickham rubber are stated to have been sold at 8*d*. per pound higher than first grade crepe, any misgivings I may have may easily be proved to have no foundation, and I shall await developments with interest, the matter being of course of the first importance to the planting industry.—INDIA RUBBER WORLD.

RUBBER GROWING IN JAVA.

A Batavia correspondent of the ECONOMIST writes:—The general tendency to class Java and Ceylon as similar rubber-producing countries must be corrected by the qualification that estates in Ceylon are roughly distinguishable as up-country and low-country, while in Java there are marked differences between the various Provinces. The conditions obtaining in the estates in East and West Java are totally unlike. Although the soil, everywhere volcanic in character, is fairly uniform, and better than Ceylon (as much of it is virgin), rainfall, which is the most important natural factor in the rubber industry, is always abundant in West Java, whereas in East there are long periods of complete drought, varying from three to nearly six months. This explains why the rubber plants are being dug up in East Java, before bearing, and replaced by coffee, which stands drought comparatively well, requires less labour and affords, in East Java, an abundant harvest and good profits. Rubber, on the other hand, grows slowly there, is expensive to maintain, and becomes productive late, while drought will often reduce the yield of latex by a half. The costs of production are high, mainly because labour is so dear, the East Javan labourer often getting one-and-a-half to twice as much pay as the West Javan.

There are, of course, exceptions, but, generally speaking, it is impossible to take a very favourable view of the prospects of rubber cultivation in Eastern Java, in which a large amount of English capital is invested. A wiser policy would be to plant the new clearings with coffee, thereby affording the company a second string, and alternative employment to the labourers engaged. Many planters in Java and in Sumatra plant coffee as a catch-crop among the rubber ; and this policy has been pursued with success, on many estates with exceptionally good soil and climatic conditions, the successful coffee crop making good the losses incurred on the rubber. But not every estate is suitable for such treatment, and better results would probably be obtained by planting the two products side by side instead of together, i.e., if 1,000 acres were divided into 500 rubber and 500 coffee.

Of West Java a better account can be given. Some of the estates contain trees superior to anything in Ceylon, and equal in growth and productivity to Sumatra and Malay.

Generally speaking, rubber-cultivation in Java is in its infancy in comparison with Ceylon, the oldest and the most extensive centre in the East. The total export is negligible as yet, and the interest of the big dealers of Batavia and Sourabaya correspondingly small in comparison with that absorbed by the major products of the country—sugar, tobacco, and coffee.

The number of rubber companies situated in Java is very small compared with Colombo, Singapore, and Shanghai. Even the rubber boom created no such great excitement in Batavia as elsewhere in the East, the peaceful Dutchman, averse to such upheavals, apparently preferred to leave others to speculate, while he pocketed the profits drawn from the sale of land to foreigners during the few months of the boom—indeed, no less than 42 million gulden are said to have been spent by Englishmen on the purchase of properties in Java. The figures may not be exact, but it is certain that the purchases made by Englishmen contained a large element of pure gift—the value of what they received from the Dutch being so much below what they paid for it.

Apart from Sumatra, which is largely internationalised, the capital invested in Java rubber is naturally mainly Dutch, and this, reinforced by the strong desire the Dutch have always shown to make Batavia, commercially and otherwise, the centre of their colonies, may lead to the establishment of a rubber market there in years to come. At present that event appears remote enough, but it is not impossible if the output of the Dutch colonies continues to grow, with the demand for it in Australia, Eastern Asia, and, possibly, after the opening of the Panama Canal, in America. The great bulk of the rubber now goes to Amsterdam, Rotterdam, London and Antwerp, and only a small proportion to Singapore and Colombo

The Dutch managers in Java create a particularly favourable impression ; rubber-cultivation in their hands has passed out of the stage of mere expansion into that of intensive culture. The average Ceylon manager has no conception of the care devoted by the Dutch planter to his plantation, the tenderness of his attention to his trees. The cost of labour is less in Ceylon than in Java ; the Tamil coolie gets 40 to 45 rupee cents (100 cents equals 1*s.* 4*d.*) per day ; the Java coolie in the best regions 40 to 50 gulden cents (100 cents equals 1*s.* 8*d.*), but the Ceylon planter does not get so much done with his cheaper labour as the Java manager does. The cost of production on those estates in Java which are already bearing vary too widely to be worth quotation ; certain it is, however, that a good estate in Java will put its stuff at least as cheaply upon the market as will those in any other country in the East.—INDIAN TRADE JOURNAL.

THE AWAKENING ON THE AMAZON.

The rubber industry of the Amazon is not by any means wiped out. Nor is it likely to be as long as there are rubber trees by the millions only waiting to be tapped. The trustees of this great industry have been profligate and extravagant in the discharge of their obligations, with the result that their stewardship is at an end, and the real owners—the people of Northern Brazil—are at length fully aroused to the seriousness of the situation and are standing shoulder to shoulder in determined effort to save their heritage.

That they have lived extravagantly in the past is no reason to believe them unable to live economically in the future. In fact the practice of rigid economies has already begun. Under the old and now discarded system it cost 60 cents' worth of food to produce one pound of islands rubber. Upriver sorts cost from 75 cents to $1 a pound. Who knows how cheaply a pound of

Para rubber can be produced under the new order of things? It is a struggle for existence by a people who are determined to live and to preserve their rubber industry. The province of Acre is already spreading the gospel of economy, and Amazonia and Para are falling into line. The State and Federal governments will be forced to reduce the burdensome taxes, and then it will be seen, and no doubt with surprise, how cheaply Amazonian rubber can be produced.—INDIA RUBBER WORLD.

EXPERIMENTS ON THE INFLUENCE OF ATMOSPHERIC ELECTRICITY ON PLANTS.

P. LESAGE.

The retardation in the growth of plants under metallic cages was supposed to be due to their protection from atmospheric electricity. Experiments were carried out with cress and also with *Datura Tatula*, and to eliminate the effect of the cage structure a batch of plants was grown in a silk cage of exactly similar dimensions to the iron wire cage containing a similar batch of plants. At the end of the three months the plants in the control batch grown in the open air were distinctly larger than the others, but there was no perceptible difference between the plants grown in the different cages. Further experiments on the evaporation of water from a plain surface showed that a cage of small mesh decreased the rate of evaporation by 10 per cent. in still air and by about 30 per cent. in moving air. It would therefore appear that the effect of the cage in diminishing the rate of growth is explained on other grounds than the removal of the influence of atmospheric electricity, even supposing this to exert any influence at all.—MONTHLY BULLETIN.

RAINFALL FOR APRIL, 1914.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	3·78	12·19	Kurunegala	5·77	9·74
Kandy	4·10	9·19	Batticaloa	·92	·81
Galle	2·28	10·57	Badulla	7·05	5·50
Jaffna	·40	1·15	Ratnapura	8·39	15·25
Anuradhapura	1·43	3·75	Nuwara Eliya	2·33	5·50

CACAO.

FERMENTATION OF CACAO.

ARTHUR W. KNAPP, B. SC. LONDON.

(Continued from page 366.)

The Beans.—When the beans are scooped out of the pod, those from diseased pods should be put on one side These must be treated separately. The rest should be freed from the placenta, "guts," or "heart." The "guts" should now be mixed with the beans, and the whole transferred immediately to the boxes.

Depth.—The beans should be put in the boxes to a depth of from $2\frac{1}{3}$ ft. to 3 ft.

Covering.—They should then be levelled down, and covered with several layers of fresh-cut banana or balissier leaves. These may be pressed close to the beans by a few boards.

Turning.—Every day they are shovelled into an empty box. It should be remembered that the principal object of this turning is to *mix*, and the beans on the outside of the box should be transferred to the centre of the empty box. Wooden shovels should be used to prevent damage to the beans.

Duration of Fermentation.—The time necessary to obtain a good fermentation varies with the kind of bean and the season of the year. With Trinidad beans, in which Forastero predominate, the shortest period is five days and the longest nine. If fermentation proceeds correctly, after three to four days the internal changes which give to cocoa its characteristic rich colour, and fine aroma and taste, are produced but the bean is still flat, and to produce a plump bean we must continue the fermentation for another two to three days.

Rise of Temperature.—If fermentation proceeds properly, then in Trinidad the temperature of the mass will be as follows :—

	Degrees Cent.		Degrees Fahr.
After 1 day ...	... 30 ...	or ...	86
,, 2 days ...	.. 37 ...	,, ...	98
,, 3 ,, ...	... 47 ...	,, ...	117
,, 4 ,, ...	... 48 ...	,, ...	118
,, 5 ,, ...	... 49 ...	,, ...	120
,, 6 ,, ...	... 49 ...	,, ...	120

How to Know when to Remove from Sweat-box.—If I were asked to give a rule, I should say: Do not remove from the box before the beans are plump,

brown without, and juicy within. The following observations on this should prove useful:—

The external appearance of the bean gradually changes from almost white to a rich brown. It should be a deep brown before removal from the box. By that time the beans will have become plump and round, and the external pulp, now of the consistence of thick paste, easy to remove.

The internal appearance of the bean alters also. If the beans are fermenting properly a notable change is observed after sixty-four hours, or, roughly, after three days. From being mottled and heliotrope, the interior has become more red, and the colour is smooth and even. From being dry inside the bean has become wet. When a bean has been juicy for two or three days, and becomes wetter inside than out, and so full of juice that it spurts out when cut, then it is well fermented. It will be noticed then that there are spaces (between the two cotyledons forming the bean) filled with a purple or brown sticky liquid.

The odour of the mass during fermentation changes from a delicate, melon-like odour to a heavy, sharp, fragrant acid odour (apparently ethyl and amyl esters with a little acetic acid). At the end the odour develops also a suggestion of sour barm.

Removal from the box.—The beans should now be removed at once from the box to the drying houses and spread in a thin layer in the sun. The first two nights they should be made into small heaps, and covered with clean banana leaves to allow fermentation to continue. That fermentation (mainly oxidation) occurs is shown by the rise in temperature. (Thus some beans, after seven days' sweating in box and one day's sun-drying on floor, were heaped 18 in. high and covered with plantain leaves. The following morning their temperature was 42° C., or 108° F.)

Of the art of drying I do not know sufficient to speak. The science of drying is to expose the beans for a long time to warm air. It is to be regretted that the temperature of the beans is permitted to fall at sundown, as the night periods are thus practically wasted from the point of view of colour change in the interior. Where artificial heat cannot be applied, an attempt might be made to retain this heat both by covering the beans with leaves, and by having the underside of the platform protected from the cool air by being double, with an air space of 6 in.—TROPICAL LIFE.

(*To be continued*)

RAINFALL FOR MAY, 1914.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	14·30	7·30	Kurunegala	4·01	7·50
Kandy	5·80	4·02	Batticaloa	1·20	0·86
Galle	9·82	10·39	Badulla	3·64	2·50
Jaffna	·76	1·30	Ratnapura	17·46	20·63
Anuradhapura	2·75	·06	Nuwara Eliya	3·16	5·79

COCONUTS.

COCONUTS IN ANTIGUA.

The question as to the advisability of planting this crop from nuts obtained from young trees has often been raised. Most growers are in favour of retaining seeds only from fully matured trees with which to establish plantations, although often good reasons for this cannot be given. The influence of the age of the parent tree on the character of its offspring is of interest, although it is probably an unanswerable question at the present moment. Nuts obtained from coconuts five to seven years old, however, do not appear to possess the same vitality as those obtained from mature trees. In Antigua, during the period under review, 250 nuts were obtained from young trees, and six months after planting only 100 had germinated. This cannot be put down to drought, for good rains were experienced soon after they were put in the nursery beds. The apparent lack of vitality shown by nuts taken from the young trees seems to be of almost sufficient importance, apart from any other consideration, to warrant advising growers to establish plantations from seeds obtained from mature trees. The germination of nuts from older trees was quicker and better than this. No germination of less than 50 per cent. has been obtained from the latter in Antigua during the last three to four years, the average being about 65 per cent.

Another point in connection with the material used for the establishing of coconut plantations of some importance, is the comparative size of the husked nut with that of the unhusked one. At the present time coconuts are not grown for coir, and apart from the probability of variations in the thickness of the husk in different varieties, it would seem that climate or soil conditions largely account for these differences.

In the case of coconut grown in Antigua, the green pericarp is usually small though the nut contained therein may be of a satisfactory size. To the casual observer the apparent small size of the Antigua nut when compared with those grown in other localities may cause unfavourable opinions to be formed regarding them, which the true state of affairs does not warrant. In this connection the following measurements were carried out.

Lots of six nuts each from Antigua, Dominica, and Nevis, respectively were taken, the external diameter of the unhusked nuts was determined in each case, the husk was removed and the diameter of the husked nut determined.

The results obtained were as follows:—

Average diameter of unhusked nuts in inches.	Average diameter of husked nuts in inches.	Difference.
	Antigua.	
5·88	4·50	1·38
	Dominica.	
8·26	4·46	3·84
	Nevis.	
7·69	4·33	3·33

The above figures are extremely interesting and illustrate in a striking manner the great differences in size which exist between the unhusked Antigua coconuts and those grown in other places; they also indicate how deceptive these appearances may be, since on comparison it will be seen that although the average difference between six unhusked Antigua and Dominica nuts was as much as 2·38 inches in favour of the latter, the husked Antigua nuts were 0·40 inch larger than the others. Much the same thing is seen when a comparison is made between the Antigua and Nevis nuts.

In the above tables only the results from the examination of six nuts from each place are given; this was on account of the fact that only a limited number from Nevis was available.—BOTANIC STATION AND EXPERIMENT PLOTS, ANTIGUA, 1912-13.

THE PHYSIOLOGY OF THE GERMINATION OF RICE.

M. AKEMINE, who, during a series of years, has studied the conditions of germination of rice, summarises the results hitherto obtained as follows :—

1. The maximum, optimum and minimum temperatures for the germination of rice are 40° C., 30 to 35° C. and 10 to 13° C. respectively From the practical point of view it is important to know that the development of strong seedlings is favoured by warm irrigation water.

2. Light exerts no influence on the germination of rice.

3. The same holds true for light of varying refraction.

4. Rice germinates equally well both in water and in air, when the grains are husked or unhusked, and when the grains are treated with water which contains oyygen or which has been deprived of it by boiling.

5. The plumule appears sooner if the grain is placed in favourable conditions than in water.

6. The radicles and crown roots develop considerably sooner in the air than in water.

7. The stem grows much more rapidly in water than in the air. The opposite is the case with the radicles and crown roots.

8. The frequent renewal of the water in the experiment had no sensible effect upon the development of the stem or roots.

9. The same holds true for differences in the depth of water, provided they keep within the limits of 3 to 20 cm. (1·2 to 8 inches).

10. The suitable degree of moisture for the germination of rice is 60 to 95 per cent. by weight of the seed-bed's capacity for water.

11. Rice grains are saturated by an amount of water equal to about 25 to 30 per cent. of their air-dry weight.

12. Rice grains cannot be made to germinate until they have absorbed about 25 per cent. of their air-dry weight of water.

13. The loss of weight of the unhulled grains during steeping amounts to only 1·5 per cent. of their weight, even after 20 days, if the temperature is 10° to 15° C (50° to 59° F).—MONTHLY BULLETIN OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

RICE.

EXPERIMENTS WITH RICE IN TONKIN.

In accordance with the general practice of tropical countries at the present day, the Government of Tonkin have instituted experiments with the object of improving the yield of rice. Experiments were begun by the selection of seed, which was carried out in 1912 by the Agricultural Inspectors. Twenty-one varieties which were said to give the best results in their particular localities were chosen, and selected seed of these to the amount of about a ton was distributed to cultivators in 1913 to be grown in comparison with the unselected seed of the same variety in each case.

The floods of 1913 damaged the crops to such an extent in some cases that no result was possible. In other cases, the selected seed was not sown, and in yet others the growers refused to allow their crop to be measured. In general, it is admitted that the experiments suffered from lack of supervision, a defect which is perhaps inherent in the system adopted. Where the experiments were carried out and figures are available, an increased yield was obtained from the selected seed. The gain in rice varied from 6·5 to 33 per cent. The results are considered satisfactory, in view of the elementary methods employed.

A second set of experiments was carried out at the instance of the "Societe des Phosphates du Tonkin" which is exploiting the natural phosphates found in several parts of the country. The Society placed at the disposal of the Agricultural authorities 250 tons of powdered phosphate, passing in the proportion of 80 per cent. through a No. 100 sieve. In the absence of any agricultural experiment station, this was distributed to cultivators, to be tried under the supervision of the Agricultural Inspectors. As before, it is admitted that this system of experimenting is defective in that it is impossible to supervise the scattered experiments effectually, and to make certain that the experimental and control fields are identical, or that both are worked in the same way, or that the manure is properly applied.

The phosphate was applied in addition to the ordinary manure, while the control fields were manured as usual. In some cases the phosphates produced an apparent gain of about 5 per cent., but in two cases there was a loss to the same degree.

The experiments are not of a high order, and the results are, as yet, somewhat indefinite, especially as regards manuring, but they afford another indication of the fact that the question of rice cultivation is now becoming a prominent one in all tropical countries. (ex Bulletin Economique de l' Indochine)

T. P.

RICE PRODUCTION IN THE BRITISH EMPIRE AND EGYPT.

INDIA.—It is estimated that about 35 per cent. of the cultivated area of British India is under the rice-crop. The principal rice-producing provinces are Bengal, Madras, Assam, Burma and the Central Provinces.

The total rice-crop for the year 1910-11 was estimated at 27,896,000 tons, and for 1911-12 at 26,099,600 tons, as against an average of 23,167,300 tons for each of the preceding five years. India exports more rice than any other country in the world. In the year 1911-12 the total quantity of rice exported amounted to 2,625,000 tons, valued at £19,371,000; of this quantity Burma contributed 73·6 per cent. Burma is less subject to crop disaster than are other parts of India; and as the rice area in Burma per head of population is 0·832 of an acre, as compared with 0·509 in Eastern Bengal and Assam, and 0·496 in Bengal, there is a larger surplus available for export. Burma rice is exported from Rangoon, and in the European trade "Rangoon rice" is now the standard, other descriptions being quoted in relation to it. Indian rice is mainly exported in the months of January to April, and arrives on the western markets almost simultaneously with supplies from Saigon, Siam, and other sources. The result of this is a depression in price, owing to the market being glutted. For Java rice, which comes on to the market some six months later, much better prices are usually obtained; and this is, in a large measure, due to the smaller supplies on the market. In view of this fact, it has been suggested that modern grain elevators should be adopted in which to store the rice in Burma, and so spread the trade over a longer period of each year. (Cf. *Burma Rice*, by the Director-General of Commercial Intelligence, India, 1912).

CEYLON.—Rice is the staple article of food of the native population in Ceylon, and the cultivation of rice is the principal industry of the village agriculturist. The total area under rice in 1910-11 was estimated roughly at 680,574 acres. A large part of this area depends entirely on the rainfall, and this renders rice cultivation somewhat precarious in some districts. The irrigation schemes at present being carried out by the Government will, it is hoped, render a larger area independent of the natural rainfall for rice cultivation. The local production of rice for the year 1911 amounted to 10,219,746 bushels of paddy, equivalent to 8,108,058 bushels of rice. The local output is, however, never sufficient to meet half the demand of the population, including the large number of immigrant coolies employed on the planting estates, and large quantities are annually imported. For the year 1911 the quantity imported to supplement the local supply amounted to 11,775,442 bushels of rice and 1,190,287 bushels of paddy. The bulk of the import comes from India.

FEDERATED MALAY STATES.—Rice cultivation is an important native industry in the Federated Malay States, but the country produces only a small proportion of the amount consumed locally. According to the *Report of the Director of Agriculture*, 1911, the area under rice for the year 1911-12 was 103,278 acres, as against 119,224 acres for the preceding year. The reduction in area was mainly due to the drought experienced in the early part of 1911, which continued over the planting season, and resulted in considerably

reducing the area planted in those districts dependent on rain. In 1912-13 the area under rice had increased to 122,751 acres. The yield of rice in 1912 was 2,645,134 bushels.

Large areas of flat, low-lying land in the Krian district of the State of Perak are now irrigated by the Krian Irrigation Works, the first extensive irrigation scheme undertaken by the Government in these States. Under this scheme, some 60,000 acres of land are irrigated, and in consequence the rice area in this district has more than doubled since 1904. Numerous river valleys throughout the State have been rendered suitable for rice cultivation by native systems of irrigation. In the Krian district the Department of Agriculture has recently issued rules regulating the planting of rice, and fixing a date by which all planting operations must be completed. This was necessary in order to facilitate the working of the irrigation scheme, but it is also hoped that it will reduce the damage done by insect pests by restricting the time during which fresh broods could arise. Experiments are being carried out by the Department with a view to improving the drainage of irrigated rice-lands and the native methods of cultivation. At Kuala Kangsar seed selection experiments are now in progress, as a result of which it is hoped to improve the yield and milling qualities of the native varieties.

FIJI.—In Fiji the cultivation of rice is entirely in the hands of Indian immigrants, who cultivate the crop for their own food supply, but the local output does not meet the demand, and there is a considerable annual import. For the year 1912 the import of rice amounted to 2,376 tons, valued at £ 27,381, and this is likely to be considerably increased in the future, when the opening up of estates will result in the introduction of a larger rice-eating population. There are large areas of swampy land that might be rendered suitable for the production of lowland rice, and also drier areas at higher elevations suitable for the cultivation of upland varieties.

AUSTRALIA.—In Queensland rice was successfully grown for some years but during recent years it has been almost abandoned for more remunerative crops. In 1892-3 the area under rice was returned at 1,113 acres, but this had fallen to 7 acres in 1908, whilst there was no record of the crop in 1909; in 1911, 15 acres were under rice.

In the Northern Territory there were 12 acres under rice in 1910-11, and 2 acres in 1911-12, but there are large areas of land suitable for rice cultivation available.

EGYPT.—In Lower Egypt rice is cultivated chiefly in the Provinces of Sharquia, Behera, and Daqalia; in the north of Gharbia, especially near Damietta; and in Upper Egypt, chiefly in the Fayum. In the neighbourhood of Gharbia particularly it is grown for its own sake, but in other localities it is cultivated chiefly as a rotation crop with cotton, berseem, and wheat on lands that have become salty owing to imperfect drainage. The large quantities of water employed for the rice-crop, and the alternate draining and flooding that the crop receives during its growing period, tend to sweeten the land by removing the salts that are injurious to most other crops.

The area under rice for the year 1912-13, according to the ANNUAIRE STATISTIQUE DE L'EGYPTE, 1913, was 242,367 feddans (1 feddan=1·038 acres), of which 229,150 were in Lower Egypt, and 13,217 in Upper Egypt. The varieties of Egyptian rice are grouped into three classes, according to the quality of grain and their periods of growth: "Sultani," a white grain of high quality, occupying the land for from 5½ to 6 months; "Yamani," white seeded, occupying the land for from 3½ to 4 months, and requiring little water; and "Sabeini," a dirty white grain, requiring much water, and occupying the land for only 2½ to 3 months. Two crops a year are obtained in Lower Egypt, and these are known as flood (nili) and summer rices. The former are sown in May, and the latter in August.

There is a considerable import and export trade in rice in Egypt.

SUDAN.—In the Sudan rice has been grown experimentally during the past few years in the Bahr el Ghazal Province, and in consequence of the favourable results obtained rice is now being grown to supply the troops stationed in that district. Experiments have also been conducted in the Upper Nile Province and in Southern Kordofan.

There is a considerable import of rice into the Sudan, the supplies being drawn chiefly from India, Egypt, and Italy. The import for the year 1912 amounted to 3,186,843 kilos, valued at £E 28,683, as against 2,234,615 kilos, valued at £E 17,829, in 1911.

NYASALAND.—It has been stated that a considerable quantity of rice is grown by natives at Kota Kota on the lake shore, and that the industry could be extended if a market could be found for the product in Europe. The prepared rice from Kota Kota is sold in Zomba at £5. 6*s*. 8*d*. per ton, but it is thought that it could probably be produced on the marshes of the Lower River at from £3 to £4 per ton, which would bring the price in London to £5. 10*s* or £6. 10*s* per ton, allowing for transport at the rates now charged for maize. The unhusked rice could be exported at a cheaper rate. The total rice crop in the Protectorate in 1912 amounted to 824 tons, and the 1913 crop was estimated at 1,511 tons.

ZANZIBAR AND PEMBA.—Zanzibar at present produces but little rice, and large shipments are annually imported from Rangoon. The hot, swampy valleys of the island of Pemba could be made to produce abundant crops of rice, but comparatively little is grown at the present time, although formerly rice was an important article of export.

Eight samples of unhusked rice from Pemba were received at the Imperial Institute for examination in May 1912.

EAST AFRICA PROTECTORATE.—Rice is grown by natives in all suitable places along the coast-belt of the East Africa Protectorate. Slight depressions in the land are usually taken advantage of in which to form the rice patch, as such situations retain rain water. In the Vanga district rice is grown on a considerable scale, the necessary water for irrigation purposes being obtained from the river Umba.

BRITISH WEST AFRICA.—On the west coast of tropical Africa rice is grown by native cultivators wherever conditions are suitable, but the local output has to be considerably augmented by imports in order to supply the demand. In Sierra Leone rice is the most important food crop, both swamp and upland varieties being grown. Most of the varieties are, however, of a

red colour, and in consequence are of little value on the European market; but a certain quantity is exported to other West African countries, about 29,000 bushels of unhusked rice being exported to French Guinea in 1912.

Experiments with varieties of rice from South India, as well as with local varieties, have been commenced at the newly established Experiment Station at Jala.

Experiments are also being conducted at the Experimental Stations in the Gold Coast with a view to obtaining a variety suitable for local cultivation.

In Northern Nigeria the cultivation of rice is said to be extensively carried on in the low-lying districts to the south of Sokoto, where large areas of swampy land exist. It is possible to develop the cultivation of this crop in the valleys of all the large rivers. As large quantities of rice are annually imported at the Southern Nigerian ports, a ready market might be found for the crop.—IMPERIAL INSTITUTE BULLETIN.

THE INDIAN AGRICULTURAL WORLD.

We have been favoured with a copy of the latest addition to the periodicals which deal with tropical agriculture,—THE INDIAN AGRICULTURAL WORLD, an illustrated monthly Journal, edited by MR. P. A. V. IYER, of Madras. The first number contains 100 pages and covers the whole field of Agriculture and Agricultural Economics. The Editor has adopted the plan of classifying the various contributions according to subjects, and a perusal of his subdivisions will show that he does not mean to allow any ramification of the industry to escape him. In whatever side of agriculture the reader is interested, he is sure of finding something worthy of his attention.

As special features of the present (April) number, MR. D. T. CHADWICK, Director of Agriculture, Madras, contributes an article on "Success in Farming," and the HON'BLE DIWAN BAHADUR L.D. SWAMIKANNU PILLAI, one on "Co-operation in Agriculture."

One of the main objects of the Journal will be to rescue information from Annual Reports and similar publications, and to summarise as simply as possible the results obtained by the various departments of the Indian Agricultural Service. In this first number, this has been done with remarkable success. Further, when foreign journals have been laid under contribution, the matter has usually an immediate application to Indian needs. If this high standard can be maintained, there can be no doubt of success.

A notable feature is the large amount of space devoted to Co-operation and Co-operative Credit. The Editor hopes to publish details of actual experience in these matters. In his opinion, "The greatest hope for India to-day, and for Agricultural India most of all, lies in the natural extension and ordered development of the co-operative idea, until it shall have spread throughout the length and breadth of this vast Peninsula." In this particular matter, THE INDIAN AGRICULTURAL WORLD should prove of interest to many in Ceylon.

T. P.

FRUIT.

CULTIVATION OF BANANAS.

(*Continued from page 299.*)

CLEARING.

If the land to be planted is covered by woodland it is better to clear this by cutting at the roots of the trees, so that as they fall the roots tear from the soil, and with skilful axemen, the fall of one tree can bring several down. This obviates the leaving of stumps which are expensive to be dug out, and if left are in the way of after cultivation. The clearing should be done 6 to 12 weeks before the time intended to plant, so that the fallen trees may dry up. Then the limbs are lopped and with the smaller wood a good burn can be obtained. If any of the trees are of value, sale can be obtained for timber, posts, or firewood, thus use would be made of all that could be disposed of, before burning. On woodland it is, as a rule, necessary to burn not only to clear the large and small wood that would interfere with cultivation, but to sweeten the soil, because such soils as have been heavily shaded for years, and have a thick covering of humus, are usually acid, and a burn sweetens them without destroying an appreciable amount of humus. If the land has had crops before and is growing up in bush, not large trees, it should be cut at least three months ahead, and any wood large enough, or prickly bush that would interfere with cultural operations, must be burned ; if soft bush it is better not to burn, but to gather into rows leaving room between to plant the bananas.

If old pasture land is being taken up, it should all be turned over three months before planting, to sweeten. It is a mistake simply to dig holes through this kind of land, and after the plants spring begin to fork and plough ; it gives quicker and better growth to turn over the land roughly, in large clods, say in August or September. This is especially needful in dealing with lands that have been uncultivated for years, and at all times with heavy clay soils. Then according to location, holes should be dug for planting between October and March, the holes should be left open for a month before planting to aerate the soil more completely.

PLANTING.

It is usual not to use suckers freshly cut but to put them down in heaps to "sweat" for a week. This starts the eyes quicker, and the man who checks the suckers in planting is better able to note those which are not likely to make good growth, or those which have many eyes, and chop off the weakest. Those suckers cost from 3*s*. to 6*s*. per 100 according to the locality and the demand for them.

If planting in dry weather it is better to plant the suckers fresh ; if there is rain and the soil is moist, it is better to put the suckers to dry a little. It is usual now to plant 12 feet by 12 feet apart, or in the very richest land and where the bananas grow tall 14 by 14. All distances have been tried in

Jamaica, from 8 by 8 up to 16 by 16, also close in the row and wide between, but the above distance has given the best all round results in general. In dry climates, without irrigation, where mulching is depended upon, the plants do not grow tall and 11 feet by 11 feet is then a very suitable distance. Close planting in the row and wide between, with leguminous crops grown in the wide rows, has much to recommend it especially in the cooler elevations, as more sunshine and heat is thrown on the plants and soil, growth is made quicker, and when the bunches shoot they invariably do so in the wide row side towards the light and air. They then fill up quicker, whereas in the heavy shade they often take five to six months to fill up ready for cutting.

The field of course has to be lined out carefully before holing. Sticks or pegs are cut, and put in where each hole is to be dug. As the first plants are those whose fruiting time can be controlled by planting to give them from 12 to 18 months to produce the bunches, according to location, and as the price of fruit is highest between March and June, some planters, not many, plant two suckers (bulbs or heads) in a large hole or two holes close together, and allow two plants to grow together. This of course gives double the number of bunches in the first year. In this method the wider distance of 14 by 14 is usually allowed between the holes to give more room. Planting 12 by 12 gives 302 plants per acre ; 14 by 14 gives 222 plants per acre, and two suckers per double hole thus gives 444 plants per acre. Two months extra have to be allowed in planting two heads per hole as the growth of the plants is slower ; naturally being so close together they retard each other, as they are both the same size.

The holes are usually dug two feet square and 1½ to two feet deep. The labourers have to be watched that they make these holes square at the bottom of the hole ; their tendency is to slope the holes in as they go down. The top earth should be flung out at one side and the bottom earth on the other, and the top earth filled in first on the top of the plants. In planting if all the stalk has to be cut off, the sucker (or head of bulb) should be laid in the hole flat ; if it has a part of the stalk or stem left, which is preferable, it should be leaned against the side of the hole, the earth should then be filled on top of it. The careful planting necessary for fruit trees is not necessary, no ramming is needed though it is better to tramp the soil in with the feet lightly to firm it. The hole should not be filled up quite level with the surrounding soil at first.—JAMAICA AGRIC. SOCIETY JOURNAL.

RICE SOILS.

KELLY in the Hawaii Agricultural Experiment Station Bulletin gives some interesting information as to the relation of manure in the clay soil of the Hawaiian rice fields. These soils are found on chemical examination to be rich in nitrogen and phosphoric acid, but poor in potash. The best results were obtained by the use of Ammonium sulphate, but organic manures it is said give even better results if applied early enough. With nitrates there is fear of decrease of crop owing to the formation of "poisonous nitrites." Dried blood acts well provided there is sufficient moisture.

It is recommended that a legume should be grown between rice crops to be ploughed as green manure : this being regarded as the best arrangement

C. D.

ENTOMOLOGY.

INSECTS INJURIOUS TO CAMPHOR.

(*CINNAMOMUM CAMPHORA*).

THRIPS,

PROBABLY *CRYPTOTHRIPS FLORIDENSIS*, **WATSON.**

In December 1913 I observed that several Camphor bushes growing in the Gardens at Peradeniya were attacked by a species of thrips. Subsequently I found that the same insect was present on the Camphor at the Experiment Station, Peradeniya, and through the courtesy of MR. GORDON, Albion, Ambawella, who at my request sent me injured twigs, I was able to determine that the insect was present there also. So far as I know this insect has not been recorded in Ceylon previously.

The injury is unmistakable and fairly obvious. Many buds are blackened and dead. Those less severely attacked do not open properly. In such a case the tips of the young leaves are blackened, and leaves that have succeeded in opening slightly are covered with black spots.

Many of the twigs bear wounds resembling canker, and others show black, slightly-sunken, oval areas cracked along the outer edges. These areas turn light brown and bear a number of small black spots. Such areas are sometimes so abundant that the twigs are tessellated. Blackened areas occur frequently in the axils of the leaves. The whole appearance of the injured twigs suggest damage by a Heteropterous or Homopterous insect rather than by a thrips.

The insects are to be found in the bud, inside the cracks on the twigs and in the axils of the leaves. Underneath the bud scales or in the cracks in the bark small, oval, black eggs may be found adhering to the twig. Under the microscope they show a polygonal, almost a hexagonal reticulation, and when crushed they break up into polygonal pieces.

The nymphs are comparatively large, orange in colour and finely spotted with crimson. The antennæ, legs and two segments at the apex of the abdomen are black. The dorsum of the prothorax bears two black spots. They move rather slowly.

The adult insect is about 1/10th of an inch long, and black in colour. The last abdominal segment is tubular and bears a ring of longer and shorter hairs. Wings are present. There is no well-developed vein and the membrane of the wing is without minute hairs. The head is longer than wide, but not twice as long as wide. The antennæ have eight segments, the two basal, the distal end of the seventh and the apical being dark-brown, while the rest are yellowish. The segments bear short hairs. The prothorax is trapezoidal, widest at the posterior end and having the posterior-lateral angles rounded. The abdomen is flattened dorso-ventrally. The insects are sluggish.

What is probably the same thrips has recently been described by MR. J. R. WATSON from specimens found injuring Camphor in Florida. I sent some of our insects to MR. WATSON and he writes me that they seem to be identical with his species.

In "THE JOURNAL OF ECONOMIC ENTOMOLOGY," October 1913, WATSON writes :—

"In the beginning of the infestation the eggs are laid between the scales of the terminal bud. If the bud has commenced to develop when the eggs hatch the larvæ first attack the new growth. If there are but a few of the larvæ on each bud, there will result a blackening and deforming of one side of the young leaves. If there are more of the larvæ the developing bud will be killed outright. The insects then attack the younger twigs when they feed in groups, the yellow larvæ being very conspicuous on the light-green shoots of the camphor.

"The bark where these groups of larvæ feed is killed, and, as it dries out it cracks. The adults use these cracks as hiding places and as a means of entrance to the cambium on which they lay the eggs. As the infestation proceeds the bark on all of the twigs is killed and the leaves are shed. This leaves the cambium as the only suitable breeding place and here the larvæ as well as the adults are to be found. A favourite feeding place is at the base of a branch. This is quickly killed and then easily broken off leaving a scar much like the one at the base of a petiole only larger and deeper."

It will be seen that the nature of the injury in Florida agrees fairly closely with the injury done here.

MR. WATSON says that it is the young seedlings in the nursery row and the young trees in the field that are killed. He thinks that its distribution in Florida indicates that it has been introduced. It is present over a large portion of Florida but so far has given trouble only in one commercial orchard. I am unable to say whether or not the insect is native to Ceylon. If not it has probably come from somewhere farther East, Japan or Formosa. [Since the above was written SHIRAKI, Government Entomologist of Formosa, has informed me that a species of thrips is injurious to the camphor there.]

WATSON recommends the use of a tobacco decoction, the spraying to be done preferably when the larvæ are on the outside of the twigs. As the eggs are not killed a second and perhaps a third spraying will be necessary. Badly infested trees should be cut out and burned.

His spray consists of the following ingredients :—

$\frac{1}{2}$ gallon whale-oil soap
$\frac{1}{2}$ gallon commercial lime—sulphur
$\frac{1}{2}$ lb. "Black-leaf 40"
50 gallons of water

These are American insecticides.

"Black-leaf 40" (Nicotine sulphate) contains 40 per cent. of nicotine, and is used at a strength of 1 to 800 or 1,000 of water. It costs in the United States about \$12$\frac{1}{2}$ per gallon, so that at the weaker strength the mixture would cost about 3·75 cents (Ceylon) per gallon. With 1 lb. of soap added to every 50 gallons of the "Black-leaf 40" spray, this preparation is useful against Psyllids, Aphids, Heteroptera and other Homoptera especially in the young stages, Thrips, and also against some leaf-miners.

A home-made tobacco decoction but one of less efficiency can be made by boiling 1 lb. of tobacco stems in 1 gallon of water.

LEAF MINER OF CAMPHOR (*ACROCERCOPS* SP.)

This pest occurs in Ceylon and inquiry regarding what is probably the same insect has been received from Burma. Species of the same genus are stated by LEFROY to have been reared from *Blumea balsamifera*, *Trewia nudiflora*, *Achyranthes aspera*, *Terminalia catappa* and *Bauhinia* sp.

The caterpillar mines under the upper epidermis of the young leaves, and causes a large blotch. Sometimes two caterpillars occur on the same leaf. The gallery seems to start from any point, but in most cases the narrowest and presumably the earliest part of the gallery occurs towards the base of the leaf and often on the petiole.

The caterpillar is orange in colour and the segments of the body are distinct. The head is large and is widest near the caudal end. It is contracted in front of the antennæ and produced into a process which widens cephalad and ends in a distinct fringe. This cephalic projection consists of two parts which work horizontally. Each part consists of two strong teeth and a membrane fringed with hairs.

The antennæ consists of three segments, and bears several finger-shaped processes and several long setae. Prolegs are present, three pairs on the abdomen and an anal pair. The abdominal pairs are on segments 3, 4 and 5. Each proleg bears a circle of hooks, there being about 22 in each circle. The caterpillars are subject to parasitisation by a small, black, yellow-legged chalcid. The grub of the parasite feeds externally on the caterpillar and its pupa occurs near to the remains of the caterpillar. Just caudad of the apex of its abdomen is a small, round, dark-brown mass, the excreta ejected by the grub prior to pupating. Several specimens of a Braconid have also been obtained from infested leaves.

The cocoon of the moth is formed in a fold of the leaf. The pupa protrudes from the cocoon at the emergence of the moth. The moth is minute and very active and has a habit of sitting up on the two first pairs of legs and vibrating its antennæ. The legs are reddish-brown. The forewings are brownish-black in colour and mottled with white in three areas, black spots occurring within the white areas. The wings are upturned at the posterior end when the insect is at rest. The abdomen and the venter of the thorax have black and white bands. The head is white, palpi black at base, white for the rest of their length except for a black band near the apex. The antennæ are white at the base. The fringe of the forewing is brownish-black; some of the hairs of the fringe have black, expanded tips toothed at the apex.

Its parasites seem to keep this pest fairly well under control. In the case of a severe attack spraying with a tobacco decoction might be given a trial.

LARGE BAGWORM (*OIKETICUS VARIEGATUS*, SNELL).

This bagworm has been recorded from Tea and Arrowroot as well as from Camphor.

The case in which the caterpillar lives is about 1½ inch long excluding the retractile part. It is made of brownish-white silk surrounded by pieces of stout twigs lying in a horizontal direction, and recalling a wood-gatherer's

bundle of firewood. On tea the case may be partly enclosed between two leaves the underside of each leaf being outermost.

Only the head and thorax are protruded when the caterpillar is feeding, the case in the meanwhile being attached to the plant by a strand of silk. The head is dark-purple with a white-coloured clypeus. The first thoracic segment is purplish-white with two broad, dark-purple, longitudinal stripes on the dorsum. The area round the spiracles is also dark-purplish. The second thoracic segment has four longitudinal, dark-purplish bands. The base of the antennæ is white. The thoracic legs are dark-purplish and end in a short claw. There are four pairs of abdominal prolegs and an anal pair. The hooks are situated in a "ring" open on the mesal side. The abdominal spiracles on the eighth segment are considerably larger than the others. The dorsum of the 8th, 9th and 10th abdominal segments is chitinised.

The caterpillars seem to make their growth very slowly. One taken on the 22nd of September and provided with ample food did not pupate till about the 8th of the following January. During that time there was little or no visible gain in size.

The caterpillar pupates inside the bag. The pupa in the case of the caterpillar referred to above was about 1 inch long, very soft, chestnut-brown in colour and tapering towards each end. The thoracic region is much corrugated, laterally compressed, and possesses a distinct mid-dorsal ridge. There is a short, transverse row of spines on the caudal margin of the second and fifth abdominal segments and also on the anterior margin of the seventh. The cremaster consists of four, short, blunt tubercles. On the venter of the abdominal region the remains of the prolegs are to be seen.

This pupa was placed in a cage. On the 13th of January a female moth emerged and crawled for some distance. Normally the female, which is grub-like, does not leave the case.

The insect was a little less than 1 inch long, and yellowish white in colour. From the head end the body widens out towards the posterior end when it narrows very abruptly. From this posterior truncated region the apex of the abdomen with the copulatory organs protrude. The dorsal edge of the truncated region is surrounded to a greater or less degree by a narrow band of fine, dark brown hair. The thoracic segments, 1st abdominal and the anterior part of the 2nd abdominal are chitinised on the dorsum and a distinct median ridge extends as far back as the 1st abdominal segment inclusive. Between the 2nd and 3rd thoracic segments on the dorso-lateral aspect projects on each side a tuft of hairs in two bunches; these may extend on to the venter. Cephalad of the head region project two short processes with a black spot at the base of each on the outer side (antennæ and eyes ?).

Slight tubercles occur on the venter of the thorax. There is a distinct triangular process on the mid-venter of the second thoracic segment. Altogether it is a curious-looking creature to be an adult moth, and would not readily be taken for such.

The male moth is winged and otherwise fully organised. The pupa of the male remains protruding from the bag after the emergence of the insect.

The following description of the male is from MOORE:—

"The male is about 40-42 m. m. in expanse of wing. The forewing is produced at the apex and is of a bright, rufous-brown colour on the anterior and posterior borders. The veins have black streaks. The median region of the wing is semi-transparent. The body is brightly coloured with black tufted streaks on the thorax and the sides of the abdomen. The palpi, base of antennæ, and legs are black-streaked."

The antennæ are bipectinate to the tips.

HAMPSON gives the distribution as—Shanghai, Canara, Nilgiris, Ceylon, Borneo and Celebes.

Probably the best way to deal with this pest is to collect and destroy the caterpillars. The size of the bags renders this comparatively easy.

BAGWORM (*PROBABLY AMANTISSA CONSORTA*).

The cases of what is probably *Amantissa consorta* have been collected from Camphor at Peradeniya. The case is about 4/5 in. long and composed of short pieces of twigs arranged in a spiral. Looked at from the anal end the direction of the spiral is seen to be counter-clock-wise. Of similar cases in the collection some shew a clock-wise and some a counter-clock-wise spiral.

The pupa of the female is brown, shining and tapers gradually from near the posterior end to the head end. The dorsum is minutely wrinkled transversely and several short bands of reduced spines occur. Five conspicuous, black bands encircle the abdomen of the pupa. The cremaster consists of a very few short spinous tubercles. Similar "bags" have been collected from tea.

I have observed two species of (Pyralid?) larvæ feeding on Camphor at Peradeniya.

One lives within the buds and is very minute. It has a black head, the black being notched into on the posterior edge. It possesses four pairs of abdominal prolegs and a pair of anal prolegs. The hooks are in a circle. Seven or eight hooks make up each ring. The body-setæ are frayed at the end. The jaws are powerful and bear several stout teeth.

The other Lepidopterous larva is larger, being about 1/3 in. long. It spins the young leaves together and eats them. It is yellowish-brown throughout. There are four pairs of abdominal prolegs and a pair of anal prolegs; the hooks of the prolegs are in a circle.

***XYLEBORUS COMPACTUS* EICHH.**

I have taken this beetle from Camphor in which it was breeding at Peradeniya. It also occurs in tea, coffee and Avocado Pear.

X. Arquatus, Wynne Sampson. GREEN records this borer from living branches of camphor. It is about 1·5 m.m. long, of a very dark-brown colour, with head and thorax bright reddish and legs and antennæ of a lighter brown.

Xylopertha sp. recorded by GREEN from dead or diseased wood.

Suana concolor, *Papilio lankeswara*, *P. clytia*, *Attacus atlas*.—caterpillars recorded by GREEN as feeding on foliage.

Lepidiota pinguis. The larva, a very large "White grub," is recorded by GREEN as feeding on the roots.

Mice have been recorded by GREEN as digging up and devouring seed in the nursery.

Mite (*Tetranychus bioculatus*). This is recorded by GREEN as occurring in injurious numbers on the upper surface of the leaves, and leaves suffering from such attack have been submitted to me.

Coptosoma siamicum. I have observed this beetle-like bug feeding on the young shoots.

Mite (*Brevipalpus obovatus*)—recorded by GREEN.

Aspidiotus (probably *A. camelliæ*). I have observed this scale insect on the buds and twigs. There are three pectinæ between the 2nd and 3rd lobes, the outermost of the three being deeply bifid. There are two pectinæ laterad or the 3rd lobe. The pectinæ between the median lobes project beyond the apex of the lobes.

Twig girdler. I have recently found that a Lepidopterous larva mines in the young twigs, often causing them to wilt and fall over. It tunnels underneath the epidermis, the tunnel running upwards for a short distance in a spiral and then striking somewhat more deeply into the tissue. The point of entrance is usually indicated by a longitudinal crack and the direction of the tunnel can be easily followed from the facts that the frass shews black through the epidermis and that the area over the tunnel is somewhat elevated.

The caterpillar is very small and is not easily found. By the aid of a pocket lens it can be made out that it is greenish in colour with head and prothoracic shield black. It possesses thoracic legs, four pairs of abdominal prolegs and a pair of anal prolegs. The hooks of each proleg are arranged in a complete circle and are about 15 in number. The mandibles are very stout and end in five or six large teeth.

The caterpillar bears a marked resemblance to the one found feeding in the buds and referred to above; in confinement the caterpillars eventually left the twigs and took to feeding on the leaves, so it is possible they are one and the same insect.

A. RUTHERFORD.

ENTOMOLOGY IN THE UNITED STATES OF AMERICA.

The February number of the JOURNAL OF ECONOMIC ENTOMOLOGY contains the annual address (1913) delivered to the American Association of Economic Entomologists by P. J. PARROTT, the retiring President.

The address sets forth much interesting information on the growth and present status of Entomology in the United States, and in view of the fact that the United States has acted as pioneer for the rest of the world in matters Entomological, the following brief summary of portions of the address may be welcome.

In 1912 forty-one states provided for the teaching of Entomology in their Agricultural Colleges; forty-three appropriated funds for experimental and investigational work; twenty-six were engaged in research under the

Adams Fund on problems that had been carefully considered and approved by a competent authority: all the states in the Union but two provided funds for orchard and nursery inspection, twenty for bee inspection and eight for combating certain particular species of insects.

The estimated amounts of money expended by the various states for the different lines of effort are as follows:—

For instruction and experimental and investigational work	$ 374,262·27
For control of bee diseases	25,625·00
For inspection of insecticides	12,523·00
For control of special insects	388,168·97
For orchard and nursery inspection and quarantine measures against insects	245,553·81
Total	$ 996,133·05

Expenditures by the National Bureau of Entomology during 1912 are as follows:—

For investigational work	$ 317,080·00
For control of gipsy and brown-tail moth	284,840·00
Total	$ 601,920·00
Grand Total for United States	$ 1,598,053·05
	= Rs. 4,993,915·78

The Budget for 1913-14 provides a sum of $ 752,210·00 for the work of the National Bureau of Entomology.

The sums expended on Entomological work by certain of the states are as follows:—

California.—$ 75,094·68; of this $ 3,000 were ear-marked for mosquito control. In addition to the above sum certain counties in California make appropriations for orchard inspection; this sum is estimated at $ 1,000,000 employing 400 men for more or less of their time.

Georgia.—$ 29,050·00

Illinois.—$ 30,550·00

Kansas.—$ 26,360·00

Maine.—$ 33,300·00; of this $ 30,000·00 is for work against the gipsy and brown-tail moths.

New Jersey.—$ 37,800·00; $ 25,000 being for mosquito-control work.

New York:—$ 78,730,69; $ 4,700 being for work on bee diseases.

Massachussetts:—$ 272,850,00; of this $ 250,000 is for work against the gipsy and brown-tail moths. In addition various Commissions and Boards spend $ 85,900,81; on these moths.

Washington:—$ 38,100.

In 1912 there were one hundred and one entomologists on the staffs of the experiment stations as against 25 in 1899. Not less than one hundred and twelve persons were engaged in teaching Entomology in the state agricultural colleges and state universities.

The Staff of the National Bureau of Entomology in 1912 comprised two hundred and fifteen technically trained Entomologists besides many other individuals who served as helpers; in 1894 the staff consisted of sixteen men all told.

Great as has been the development of Entomology in the United States in recent years a further development is confidently anticipated. In States where funds are more ample the work of instruction is being separated from that of experiment or investigation. Formerly the Station Entomologist had to conduct instructional and investigational work, as well as direct all the other Entomological projects.

Further there is a growing tendency to subdivide activities by creating Divisions dealing with insects of particular crops—as fruit insects, cereal insects, truck-crop insects.

The nursery and orchard inspection work is gradually being taken over from the station Entomologist by the State Administrative Service charged with the enforcement of agricultural laws, and in connection with the extension departments of the agricultural colleges special officers are being deputed to give field demonstration experiments of the recommendations of the Entomologist.

All this means money, but the American tax-payer has confidence that his money is being well spent in furnishing him with weapons wherewith to fight the enemies that would deprive him of the fruits of his labour.

"The rapidity of development and the present financial support are convincing proofs of the vitality of Entomological effort of to-day in this country and of its increasing economic importance in the eyes of the commercial and scientific public."!

A. RUTHERFORD.

CHILI CULTIVATION IN AMERICA.

"Paprika" is the pungent red pepper got by grinding a Hungarian variety of *Capsicumannum* grown in America. YOUNG AND TRUE in Bulletin No. 43 of the U. S. A. Department of Agriculture state that the quality depends on colour, pungency, sweetness and flavour. The colouring matter which is found in the shell is preserved by grinding together shell and seed, the seed containing an oil in which the colouring matter is soluble. Pungency is due to the presence of a crystalline substance, Capsaicin ($C^9 H^{14} O^2$) found in the placentæ of the pods. Sweetness is due to the sugar in the shells.

In South Carolina the growing period runs from 230 to 240 days with a mean summer temperature of 78° F. The following figures are of interest :—

Average Yield per Acre.	Price per lb,	Total income per Acre.	Average cost per Acre.	Average profit per Acre.
1,092 lb.	9·3 cts. (American)	$102·23	$31·97	$70·26

C. D.

POULTRY.

THE TREATMENT OF THE GROWING CHICKENS.

In rearing fowls a common mistake is to neglect the older birds for the sake of the young ones. Many are apt to think, when chickens are over the first perils of babyhood, they need no further care. Many a mistake is made here. The birds are growing fast now and they must be fed well or all the pains bestowed on them will be lost, whether for the fattening-pen or show-pen, for it greatly depends on the progress they make within the next few weeks whether they turn out fine birds or not. Avoid over-crowding, but see that proper ventilation is given. Coops are much better not shut up at all, but if there is a fear of rats or other vermin a slide covered with fine mesh wire-netting had better be substituted for the ordinary shutter. If this precaution was taken there would not be half the cases of roup and cold as when the birds are over-crowded and thus over-heated at night; they are almost certain to get cold when let out in the early morning. As regards those chickens which have left the hen, the provision for their accommodation must depend on the nature of the chickens to a certain extent. If of a strong constitution they can at once be put into a small fowl-house by themselves, but they should on no account be put with the older fowls or allowed to roost at this early age. Do not take the hen away from the chicks until they are well on their feet . . . . . At from ten to twelve weeks old the cockerels should be separated from the pullets, and only chickens of the same age be placed in a run together or the weaker ones will stand no chance. Without separating the sexes the birds will never grow so large; besides, it prevents trouble, as a number of cockerels may be kept by themselves till fully grown. Perfect cleanliness is absolutely essential. With regard to food, four meals a day is enough, but they must have it at regular times, just enough to satisfy them, and none left. Some animal food may be given, but this should be supplied very sparingly to the pullets. Look out for vermin; many chickens are lost by nothing else but vermin. See that the hen is well dusted with insect powder; also have the coops cleaned out regularly on a fine day. Feed on good wholesome food; never give condiments or too stimulating foods. Whole ground oats are excellent with chopped wheat. Many feed too much on egg food, which is, on the whole, a mistake, especially where chickens are confined. It puts the bowels wrong, and this is the greatest source of danger to chickens. The test of good chicken rearing is never to allow the bowels to get out of order, and this may be done in ninety-nine chicks out of the hundred if people will avoid patent and stimulating foods and give only good wholesome food with abundance of green food and small sharp grit. Give chickens plenty of fresh air; avoid rearing them in lofts, greenhouses, &c. Wet is bad for chickens, but they cannot have enough of fresh air. Get the coops into the

sun as much as possible during the cold weather, but, of course, use discretion if there is a long period of intense heat. See that the drinking water is given fresh and often. Feed early and late. Always endeavour to look round the coops last thing at night to see all is going on right—it pays well to do so.—C. B. Taylor in "Feathered Life."

THE WHITE WYANDOTTE.

J. STEPHEN HICKS.

COLOUR.

In the early days of every white breed or variety of poultry there is always a decided scarcity of birds with any pretensions to purity of colour The reasons for this are not far to seek: strains have not become properly established, a good deal of out-crossing (in blood-lines if not in breeds) has to be resorted to, and the old red pigment belonging to the varieties from which the whites sported still evinces itself in brassiness or ticking—either sandy or black.

One must always remember, too, that it is the all-powerful law of supply and demand that helps any variety along in its struggle towards perfection, and that a white variety bred by few will never attain to any general purity of plumage. It is, then, its great popularity that has greatly helped to make the white Wyandotte of such all-round excellence in colour, for, twelve years ago, the general ruck of exhibits failed lamentably in this respect: one would find sunburned hackles, patches of sap, yellow undercolour and quills on specimens in the money at the biggest shows, though I do not mean to suggest that all exhibits necessarily showed these defects.

At the present time, yellow or sunburned birds are seldom seen in the show pen; they are all more or less white; while I am not afraid to say that the dead white, chalk white bird is as much a rara avis as ever; specimens that look white enough in their pens show tinges on the wings, hackles and tails, when handled in a good light. It may seem a surprising statement that there were under a dozen dead white exhibits at the last club show of the White Wyandotte Club, but I make that statement nevertheless. The fact is that there are ever so many degrees of whiteness, and it is not until you pen a good coloured bird against a better coloured one with a best coloured bird next to that, that you realise it. The champion at the East Midlands Show, then described as "very pure," can only attain third place in the London novice class, and there we hear he is "behind winners in colour;" everything is so comparative, you see.

Good as white Wyandottes are on the whole, there is still a vast amount of room for improvement in colour; we hear a lot about "stay whites," but where is the breeder who can wash and exhibit you six such birds—old ones which have had their liberty—in July? The man who owns a couple of them has reason to be proud of his strain. We have more or less eliminated sap and faulty undercolour, but the faintly tinged bird is still with us, and the only true test is a bird's ability to withstand exposure.

The modern tendency to protect and confine the growing stock is to be deplored inasmuch as it prevents the breeder from knowing which are his genuine white birds and how they are being produced. It is probable that insufficient attention is paid to colour in the breeding of females, and improvement could undoubtedly be made more rapidly by rigid selection on this side of the pen.

It is noticeable that a red-winged male is often of the purest white elsewhere. It is pretty certain, however, that this tendency will be handed on to the progeny of such a bird, and he should never be used for breeding unless (1) you know that his parentage is sound for at least two generations, (2) he is the only such bird in your flock that year, and (3) he is really excellent in all other respects. Provided he answers satisfactorily to all these requirements, he should, well-mated, throw good chickens; but, even so, the experiment is risky. No risk, on the other hand, attaches to the use of a male with a few black-ticked feathers, though there is a limit, of course, to the amount and extent of this ticking, while the mates of such a bird would need to be more or less free from the same peculiarity.

SIZE.

According to the scale of points drawn up by the executive of the White Wyandotte Club, size is allowed to count for fifteen points, while colour and type are worth twenty-five each out of a hundred. Therefore you will see that a specialist judge must not unduly consider the importance of size; in fact, by this same scale he is supposed only to value it equally with the whole of the head points. The fact remains, though, that a good big bird will always beat a good little bird, and no English fancier will be likely to grumble at such judging, provided (and here's often the rub) the big bird is really good.

Under the score-card system—until a few years ago almost universal in the States—it was the practice to "cut" so many points for birds deviating either way from the weights laid down in the standard. This system possessed, at any rate, one advantage, in that it enabled breeders to know exactly what size of exhibit to aim for. Our own standard weights—cock, 10 lb.; cockerel, 8 lb.; hen, 8 lb.; pullet, 6½ lb.—are rarely considered even by the specialist judge. In fact, the word "about" appears as a prefix in the standard to these weights.

By all means let us have big white Wyandottes, if we can at the same time preserve quality and true shape, but so many of these extra big birds are mere clodhoppers, coarse and angular, lacking the grace and aristocracy of bearing that characterises the correctly-bred specimen. We have more or less educated the average judge so that he will leave cardless the giraffe-like specimen, but he is now inclined to go to the other extreme and award prizes to the heavy-headed, bull-necked, coarse-boned, loose-feathered lout of a bird, that is no more a true white Wyandotte than the other; my latter remarks apply more chiefly to females.

If size is to be obtained only at the expense of quality, then I say, most emphatically, let size go; otherwise it is just as much a good attribute to the ideal specimen as any other feature, and should be striven for as such.—"POULTRY."

NUWARA ELIYA POULTRY SHOW.

APRIL 13, 1914

The Nuwara Eliya Show may be voted to have been a great success. MR. PRESTON PLUMRIDGE won all the specials with his Black Orpingtons.

This breed seems to catch the judge's eye more than any other.

There were more plumaged breeds penned at this Show than ever before, but it requires an expert to judge them.

The Black Orpington is undoubtedly an easy breed to show. They are typical and no washing is necessary, but

We shall want another rubber boom before next January, if we are to import birds up to this year's quality.

It was good to see so many new names amongst exhibitors.

Some of them might remember that soap and water is cheap, and that it does not hurt a fowl to be washed.

All the details of the Show were most carefully and thoroughly carried out by our keen and energetic Hon. Secretary, and everything passed off without a hitch.

Our hats off to him for having made such a handsome profit out of the Show.

Who said the Club was dead?

May we see MR. BULLMORE, over at the August Show.

One opinion is all we want at our shows.

Too many judges are like too many chickens in a foster-mother—they are always falling over each other.

May MR. STURGESS wield the wand again at future shows. His awards gave general satisfaction, and not a murmur was heard.

MRS. MARCEL'S La Bresse Cock shown in the pairs was a good one. His lobes were a little red which was a pity.

The following are the awards that have been won by MR. PLUMRIDGE'S Black Orpington hen.

1st at Gloucester Show; Cup for best in Show at Gloucester; 1st. at Radstock; Cup for best in Show at Radstock, and 1 special; 2nd. at Birmingham; Two 1st at Nuwara Eliya; and Cargill's Cup.

Below will be found the full results of the Ceylon Poultry Club's 21st Exhibition of Poultry. All members of the Club who visited the Show should have left feeling well satisfied with both the exhibits and the excellent manner in which the Show was managed. Taking each class in turn the Barred Rock Hens were a good exhibit. The winner, which has been twice placed 1st. in previous shows, is a large massive hen and handles very heavy. Pen No. 1 shewed the best barring but was on the small side for a Rock.

In the Imported Wyandotte Hen Class the winner seemed to win with a lot to spare.

MR. PRESTON PLUMRIDGE'S Buff hen won comfortably in the Imported Class, and was very even in colour. A darker buff than that seen is what the judges require at home just now, but every one who has kept this breed in Ceylon knows how difficult it is to retain the proper colour.

In the country bred hens, although the pullets were on the small side and rather lacking in the Orpington type, must be considered one of the best exhibits of this breed seen in Ceylon Shows for some years. The two cocks exhibited by MR. PRESTON PLUMRIDGE and MRS. C. W. JONES in the Black Orpington Class were a very hot pair. In type there is very little to choose between them, and without handling either of them it would appear that the former's bird won being rather more advanced in plumage. It will be interesting to see how they are placed at the next show. The Australian Cock owned by MR. PRESTON PLUMRIDGE, and which swept the board at the last Colombo Show, seemed to have fallen off a lot, and was in poor feather.

MR. PLUMRIDGE'S Black Orpington Hen, which was placed second in one of the Classes at the Birmingham Show, won fairly easily. She may be considered the best of her Breed ever seen at Ceylon Shows.

The country-bred hens and pullets were a fine class. The winner has been in the same place before, and is a large hen for a country-bred. MRS. JONES' pullet should be placed nearer the top when a few months older.

Taking them all round the Blue Orpington Hens were a very disappointing lot. The judge's fancy was for size, and pencilling was not taken much into consideration. This is an expensive breed to invest in and high prices are asked for the best birds, and these have undoubtedly still to be imported.

In the Imported Blue & Buff Class, MR. CONGREVE'S Cock won easily. MRS. REISS' Blue was fairly nicely laced on the breast but showed red in the neck hackle and was also on the small side.

In the White Orpington Hen Class, MRS. JONES' hen was quite the finest exhibit of this variety ever seen in this country. She was quite typical and was snowy white—beautifully shown.

In the Game Cock Class MR. DIAS' bird won. He is a son of the great Rajah, but is not a patch on his father. He has good bone but goes off too much in body. The hens were a rather poor lot, running small. It is, no doubt, not a good time of the year for this breed as they are generally moulting at this season. We must hope that MESSRS. DIAS & JANZI have better birds for the next show to compete for the Country-bred Cups.

All the Minorcas & Black Leghorns were utility type and require no special notice. MRS. JONES' White Leghorn hen stood out in her class and was a nice hen, winning also the special given for the best hen of any light breed.

In the A. O. V. heavy breeds, cocks, MR. HARRY JONES' White Wyandotte was placed first, and in the light breeds MRS. REISS' Brown Leghorn was a bird of exceptional quality. In the A. O. V. country-bred and selling classes there were no exhibits to call for special notice. MRS. MARCEL'S entry of Bresse fowls was of interest. They are smaller than a Leghorn but have the reputation of being good layers of large eggs and a nice fowl for table purposes.

The Competition for the Meaden Cup was most satisfactory, and MISS CICELY KERSHAW had hard luck in not winning. There must have been very little to choose between the winners and her excellent pair of Golden Wyandottes. The Blues were lucky to have been placed 3rd, the cock standing rather high on his legs and being distinctly squirrelled-tailed, and lacking

any pencilling on the breast. The Bantams were a most interesting lot and MRS. ASTE's buff Pekin hen was as good as any seen at any home shows. The special went to a rather poor specimen of a Black-red O. E. Game cock, with a lot of red about his breast, and quite lacking in contrast of colour, which is a most important point in this breed. The neck and saddle hackle were very dark in colour.

MR. PLUMRIDGE's Black Orpingtons carried off all the specials.

In conclusion the club's best thanks are due to our Hon. Secretary, MR. C. W. JONES, for all the hard work he has put in to make this Show a success, and for the excellent way in which it was run in every detail.

It was a disappointment that MR. A. C. BULLMORE was at the last moment unable to come over to judge the Show, but MR. STURGESS' awards gave great satisfaction all round, and our best thanks are due to him for the arduous work he put in at judging the whole Show. We must hope he will undertake to do the same at our next Show, which should be held about August.

SPECIALS.

Best Bird in Show.

Won by MR. PRESTON PLUMRIDGE's Black Orpington Cock.

Best Imported Cock.	do	do	do
Best Imported Hen.	do	do	Hen

Meaden Cup for Best Imported Pair. MR. P. PLUMRIDGE's Black Orpingtons.

Special presented by a Maskeliya member for Best Light Breed Hen. Won by MRS. C. W. JONES' W. Leghorn.

Special presented by MISS DELGA REISS for Best Bantam. Won by MR. LESLIE-MELVILLE's O. E. Game.

RESULTS OF THE POULTRY SHOW

Held at Nuwara Eliya on 13th April.

PLYMOUTH ROCKS.—Imported Hens or Pullets.

1st, Mrs. Reiss ; Reserve, Mrs. Reiss ; V. H. C., Mrs. Reiss ; H. C., Mrs. Reiss.

WYANDOTTES, WHITE.—Imported Hens or Pullets.

1st, Harry Jones ; Reserve, Harry Jones ; V. H. C., Harry Jones.

ORPINGTONS, BUFF.—Imported Hens or Pullets.

1st, Preston Plumridge ; 2nd, R. J. Congreve ; Reserve, R. J. Congreve ; V. H. C., Miss Dias Bandaranaike.

ORPINGTONS, BUFF.—Country-bred, Hen or Pullet.

1st, Mrs. Marcel ; Reserve, R. J. Congreve ; V. H. C., Mrs. Marcel.

ORPINGTONS, BLACK.—Imported Cock or Cockerel.

1st, Preston Plumridge ; Reserve, Mrs. C. W. Jones ; V. H. C., Preston Plumridge.

ORPINGTONS, BLACK.—Imported Hens or Pullets.

1st, Preston Plumridge ; 2nd, Preston Plumridge ; Reserve, K. H. Plumridge ; V. H. C., K. H. Plumridge.

ORPINGTONS, BLACK.—Country-bred Hens or Pullets.

1st, Preston Plumridge , 2nd, Preston Plumridge ; 3rd, K. H. Plumridge ; Reserve, Mrs. C. W. Jones ; V. H. C., Preston Plumridge ; H. C., W. H. Brymer.

ORPINGTONS, BLUE.—Imported Hens or Pullets.

1st, Percy Aste ; Reserve, Percy Aste ; V. H. C., Mrs. Reiss.

ORPINGTONS, BUFF AND BLUE. Imported Cocks and Cockerels.

1st, R. J. Congreve ; Reserve, Mrs. Reiss ; V. H. C., Miss Dias Bandaranaike.

ORPINGTONS, WHITE.—Imported Hens or Pullets.

1st, Mrs. C. W. Jones ; Reserve, Mrs. C. W. Jones.

GAMES, INDIAN.—Cocks or Cockerels.

1st, W. P. H. Dias ; Reserve, W. E. A. Janzi.

GAMES.—Hens or Pullets.

1st, W. E. A. Janzi ; Reserve, W. P. H. Dias.

MINORCAS, BLACK.—Imported Hens or Pullets.

1st, Mrs. L. A. Wright ; Reserve, Mrs. L. A. Wright ; V. H. C., Mrs. Reiss.

LEGHORNS.—Imported Hens or Pullets.

1st, Mrs. C. W. Jones ; Reserve, Mrs. C. W. Jones ; V. H. C., Mrs. C. W. Jones.

LEGHORNS, BLACK.—Imported Hens or Pullets.

1st, Mrs. P. H. Aste ; Reserve, Percy Aste ; V. H. C., Percy Aste.

A. O. V.—Heavy Breeds, Cock or Cockerel, Hen or Pullet.

1st, Harry Jones, W. Wyandotte ; Reserve, Mrs. F. A. Boucher, Barred Plymouth Rock ; V. H. C., Mrs. Reiss, Barred Plymouth Rock.

A. O. V.—Imported, Light Breeds, Cock or Cockerel.

1st, Mrs. Reiss, Brown Leghorn Cock ; 2nd, Mrs. Reiss, Old English Game Cock ; Reserve, Mrs. Reiss, Brown Leghorn Hen ; V. H. C., Mrs. Huyshe-Eliot, Black Minorca Cock.

A. O. V.—Country-bred, Cock or Cockerel.

1st, R. Leslie-Melville, Barred Plymouth Rock ; Reserve, Mrs. L. A. Wright, Black Orpington.

A. O. V.—Country-bred Hens or Pullets.

1st, Mrs. Reiss, Barred Plymouth Rock ; Reserve, Harry Jones.

LA BRESSE.—Imported Cock or Cockerel.

1st, Mrs. Marcel ; Reserve, Mrs. Marcel ; V. H. C., W. de Lemos.

LA BRESSE.—Imported, Hen or Pullet,

1st, Mrs. Marcel ; Reserve, Mrs. Marcel ; V. H. C., Mrs. Marcel.

IMPORTED PAIRS.—Cock and Hen, any Pure Breed.

1st, Preston Plumridge, Black Orpingtons ; 2nd, Miss Cicely Kershaw, Golden Wyandottes ; 3rd, Percy Aste, Blue Orpingtons ; Reserve, Mrs. C. W. Jones, White Leghorn ; V. H. C., Mrs. Boucher, Barred Plymouth Rock ; H. C., Miss Alice Dias Bandaranaike, Buff Orpington.

BANTAMS.

PEKIN BUFF.—Hen or Pullet, Imported or Country-bred.

1st, Mrs. P. Aste ; Reserve, Mrs. P. Aste.

PEKIN.—Black and White Hens or Pullets.

1st, Mrs. C. W. Jones ; Reserve, Miss Delga Reiss ; V. H. C., Mrs. C. W. Jones.

A. O. V.—Cock or Cockerel.

1st, R. Leslie-Melville, Black-red O. E. Game. Reserve, Mrs. Aste, Buff Pekin ; V. H. C., Mrs. C. W. Jones, Black Pekin.

JAPANESE.—White Cock or Cockerel.

1st, Miss Delga Reiss ; Reserve, Mrs. C. W. Jones ; V. H. C., Mrs. C. W. Jones.

JAPANESE.—White Hen or Pullet.

1st, Mrs. C. W. Jones ; 2nd, Mrs. C. W. Jones ; Reserve, Mrs. C. W. Jones ; V. H. C., Miss Delga Reiss ; H. C., L. P. Larsen.

DUCKS.—Buff Orpington, Drake or Duck.

1st, Reserve and V. H. C., Mrs. L. A. Wright.

PIGEONS.—Magpie, any colour, Cock or Hen.

1st, Reserve and V. H. C., A. le P. Jones.

PIGEONS.—A. O. V. Cock or Hen.

1st, A. le P. Jones ; 2nd, J. V. Baldwin ; Reserve, A. le P. Jones ; V. H. C., J. V. Baldwin ; H. C., A. le P. Jones.

EGGS.—Fowl, White or Tinted.

1st, Edwin de Livera, Tinted ; 2nd, Mrs. L. A. Wright, White.

SELLING CLASS.—Rs. 15 Limit

1st, Miss Clark, White Orpington Cock ; V. H. C., L. H. Deed, Buff Orpington Hen.

SELLING CLASS.—Rs. 7·50 Limit.

1st, Reserve, and V. H. C, Miss Clark.

PATRON OF THE CLUB.

The members of the Ceylon Poultry Club should be honoured at having as their Patron H. E. SIR ROBERT CHALMERS, K.C.B. I had the honour of taking His Excellency round the Show in Nuwara Eliya on April 13th, and the very kind interest shown in all the different breeds and varieties proves that His Excellency is the Patron we have been looking for for a long time, and one who in his position as Governor of Ceylon, can, and I feel sure will, help the Ceylon Poultry Club to realise their great hope, that of improving the type of poultry throughout the Island. His Excellency has very kindly offered a Challenge Cup to the Club, and the Committee have suggested that this should be given to what we should all consider the most important class in our Shows, viz.: the Best Breeding Pen, cock and two hens, country-bred—all

birds to be bred and exhibited by the owner, in whose yard they must have been raised. It now rests with members to make this class the feature of our Country-bred Shows held every August.

The thanks of the Club are due to MR. A. W. SEYMOUR, President, and MR. E. F. EDRISINGHE, Hon. Secretary, of the Nuwara Eliya Agri-Horticultural Show, for the splendid building they put up for us and for the great trouble they took over it.

C. W. JONES,

Hon. Secretary and Treasurer,

C. P. C.

[I would propose that His Excellency's Cup be given for cock and three hens.—HON. EDIT. SEC.]

SOME SUGGESTIONS.

DEAR SIR,—May I suggest that at future Shows there be an annex with sufficient pens for all nominated birds for the specials. That when the specials are being judged the nominated birds be taken and penned in the annex, as I am sure it would make it far easier for the Judge, than at present having to run backwards and forwards from one nominated bird to another.

May I also suggest that the Judge publish the points awarded by him to each nominated bird.

Yours, etc.,

F. J. REISS.

FOWL THEFTS.

TO THE EDITOR, THE CEYLON POULTRY MAGAZINE.

DEAR SIR,—As fowl thefts are so very common at times in Ceylon in all parts of the Island, might I suggest a simple remedy which might prove useful in tracing the thieves ?

I recently purchased from MR. A. C. BULLMORE, of Madras, a small hand toe punch, a very small instrument, worked with the thumb and finger. costing a rupee or so. I have toe punched all my poultry.

In the event of a theft say of some fowls, perhaps an odd foot of a fowl (which naturally cannot be eaten, might be thrown on or about the premises of the thieves) with a private punch mark, would lead to detection,

Natives, in my opinion, would not think of looking for such a mark, and armed with such proof, think would lead to a conviction.

Yours faithfully,

TOE PUNCHER.

Low Country, Ceylon, 26th April, 1914.

CO-OPERATIVE CREDIT MOVEMENT.

CREDIT AND CO-OPERATION AND RURAL INDUSTRIES IN CEYLON.

W. A. de SILVA, J. P.

The development of rural industries in a country depends to a very large extent on the condition of the credit of the rural populations. Every industry requires a certain amount of capital outlay before it can become a permanent source of income to those engaged in it. The capital required in the villages has either to come from more prosperous landowners or from the lenders of money. These two sources, when they are normal, conduce to the welfare of the country. Where the large landowning classes exploit the labour of the villager for their own use, the supply of capital from that source does not take a normal course; where the money lender takes advantage of the helplessness of the villager, his trade becomes one of exaction; and between these two sources the villager becomes helpless. Many remedies have been suggested and have been tried in different countries to counteract these evil results. One that has been tried and found wanting is restrictive legislation. A second means employed has been charity—charitable donations by philanthropists or by the State. This, too, has failed to ensure the desired results, for charity can never stimulate industry, or build up any permanent stability in the condition of the people who receive it.

The one great factor that can and that has from experience done most for improving the condition of a people has been the discriminate encouragement of self-help and self-reliance. It is on these lines the co-operative credit movement has been able to do so much good in countries where it has been tried. The beneficial results of this movement are apparent in Germany, Denmark, Ireland, and India.

It has to be borne in mind that systems, however beneficial they may be under certain conditions, cannot produce similar results under a different set of conditions. It is on this principle that those in Ceylon interested in the co-operative credit movement should seek information and experience.

Sometimes we are too ready to generalize, particularly in regard to rural affairs. Instances are not wanting in Ceylon where these generalizations have resulted in disappointment.

One must, therefore, be very cautious before advocating the adoption of even a system that has succeeded well in another country. The conditions of rural life in Ceylon differ in certain respects very much from those prevailing in India and certain parts of Europe, from where we have to glean the experience of successful experiments in the co-operative credit movement.

In India the villager is usually a tenant in what may be called two degrees. The paramount landlord is the State that obtains a heavy land tax, often absorbing a very large percentage of the average profits of the landlord. The landlord in his turn exploits the rural population, who have to work hard to gain a bare living after payment of the landlord's dues. Under these conditions the professional money lender flourishes and carries on his trade according to his own will. The Co-operative Credit Societies in many instances have relieved the cultivator from this last evil.

In some parts of Europe the State ownership of the land is absent, but in its place there is the landlord who possesses very large areas with which he can do whatever he likes. The tenant so far, as a general rule, has no inducement to improve his holdings, and hardly any means of doing it where he wishes to do so. These conditions are being changed in recent times, and the Small Holders Acts and Co-operative Societies are helping to remedy some of the drawbacks.

The conditions in Ceylon differ vastly from those prevailing both in India and in many parts of Europe. The Ceylon villager usually is a free holder of land. The extent of land held by one individual may be very small, but the fact remains that over nine-tenths of the people own their own lands. The professional money lender does not, as a rule, exist in the village, though from year to year the influence of the lender is increasingly apparent in certain districts. The standard of living and comfort of the Ceylon villager is much higher than that of his Indian contemporary, as also is his standard of intellectuality, and superior, too, to a large majority of his contemporaries in Europe.

It is well to inquire into the actual drawbacks suffered by the Ceylon villager.

As the population increases, the extent of land owned by him is gradually diminishing, and he finds that he has no means of acquiring new lands or settling in new districts. He has no reserve capital or any appreciable surplus from his ordinary industry to enable him to engage in any investment on his land in the form of improvements, such as the obtaining and maintaining a sufficient supply of ploughs and draught cattle, or of obtaining and using fertilizers and manures.

He finds that the cost of necessities is increasing in price, and he has no means of combining to buy his requirements at reasonable rates.

He finds that his opportunities for the ready sale of his produce at reasonable rates are greatly restricted.

His freedom of action in engaging in new industries is more and more restricted on account of regulations and rules that come into force for the protection of large owners and on account of the more strict conservancy of State resources. His indebtedness on the security of his holdings is increasing daily, and he gets more and more into the hands of the capitalist landowner, who often advances him money on high rates of interest with the object of eventually acquiring his holding.

It is to meet and counteract these conditions that credit and co-operation among the Ceylon villager has to be shaped and organized.

The best form of a village Co-operative Credit Society is the one known as the Raiffeisen Bank. These banks depend on the integrity and capacity of their members, and on the personal knowledge of the members of one another.

Each society, therefore, covers only a small area. The members are jointly and severally liable for the obligations of the society. No salaried position must exist in these societies. The benefits of the bank are open to the poorest, if he be trustworthy; and the wealthiest, if he becomes a member, must submit to the liabilities of the concern. It is a capitalization of honesty.

In Ceylon we have in every village a number of persons who own land and who are fairly well-to-do. Banks of the above description give them an opportunity to help their fellow villagers by co-operating with them, for when they are not able to spare capital for investment, they are able to ensure the status of the bank and its position for credit by the mere fact of their joining and taking part in the management of such societies.

There is, however, one essential element wanting for the successful establishment of these banks. A Raiffeisen Bank can be established under the best conditions in a Ceylon village, and can be made a unit of sound security for any capital that may be advanced to it, but the source of capital is non-existent. One of the first requirements, therefore, for the successful working of any system of Co-operative Credit Societies is the establishment of a Central Credit and Land Bank. This, as I have mentioned before, should not be a charitable or philanthropic institution, but a sound business concern based on purely business lines.

A Land and Credit Bank will meet three principal requirements in Ceylon :—

(1) It will be the means of supplying capital to Co-operative Credit Societies on the security of the individual and joint liability of the members. A village Co-operative Credit Society should not be stunted or limited through lack of sufficient funds, when on a business basis the credit of the society through its individual members stands high. The people who need most the aid of such societies are the poorest members of the village, who are, perhaps, unable to contribute anything towards its fund.

(2) It will be the means of supplying capital for the purchase of land, or the raising of loans on mortgage bonds on lands, to be repaid with interest by yearly instalments extending over a large number of years. It will also enable the rural population to acquire more land and to purchase land and settle themselves in new areas.

(3) It will enable the village societies to obtain capital for co-operative industries, purchase of economic necessaries, and the distribution of their produce to advantage.

There are many small cottage industries in the villages which should flourish where those engaged in them are able to obtain the raw materials at a reasonable price. The metal workers have now to pay twice and three times what they actually should pay for their raw material. Lace-workers and those engaged in embroidery and fancy work find it difficult to procure

materials of suitable good quality. The weavers are without means for obtaining necessary yarn and looms. The dyers pay exorbitant prices for very inferior dye stuffs, which even depreciate the value of their work to a great extent. The wood-worker has no stock of suitable wood to carry on his trade. The cultivator finds it difficult to get fertilizers and seed at anything like a reasonable price. A Co-operative Society can buy such raw materials of a superior quality at reasonable prices and distribute the same among the workers. The sale of produce is also attended with difficulties : the middleman who advances money makes a very large profit, leaving the worker hardly a sufficiency as the fruits of his toil. The villager often has to travel long distances to sell his produce, and spend much time and labour in doing so. The surplus produce from the field is collected by the petty trader on his own terms. A Co-operative Society can collect all the produce of the industries of the village and sell the same to greater advantage. Such a combination in the village will also solve the problem of the difficulties now experienced in the sale of certain produce, such as cacao, arecanuts, &c., and in procuring the necessities of the villager, such as cloth and food stuff, at a cheaper price than obtainable from the itinerant trader and the boutique-keeper.

A Land and Credit Bank will have in the first instance to be a State institution ; later, when banking and financial experience become more available in the country, such banks may pass into the hands of private corporations. The Land Banks originally established in Egypt were State institutions. In Prussia, where the co-operative credit and rural banking system is being so successfully worked, there is a Central Bank established there since 1895—"The Prussian State Co-operative Central Bank"—endowed by the State with a capital of £3,750,000 sterling."

The departmental committee appointed in 1911 by the Board of Agriculture and Fisheries in England has recommended that in England the State should advance the sum of £500,000 to contribute the capital of a Land Bank. A State Land and Credit Bank is more necessary here than in Europe and elsewhere, as free capital is very scarce in Ceylon, and the knowledge and experience of banking and finance is almost non-existent in this country. If a State bank is required in Prussia, and if such a bank is considered to be essential for the working of rural credit schemes in England, the necessity for an institution of this nature in Ceylon need not be emphasized.

A State Central Bank when established will draw around its nucleus of original capital a large amount of money in the form of current accounts and deposits and should prove to be a flourishing institution, which at the same time will give the required help for the general development of the people of the land.

It is only with the aid of such an institution that co-operative institutions can readily come into successful existence, and only through such means can the rural population be freed from unnecessary exactions on their industry, which they now pay in excessive rates of interest, and can be encouraged to take up and develop new land, to settle and colonize the vast tracts of the Wanni. Only through such means can we expect to bring the benefits of co-operation, such as co-operative buying and co-operative selling, within the reach of the

people. There is, then, the urgent need for the introduction of two principal elements for making the co-operative credit movement in Ceylon a success:—

(1) The freeing of credit societies from restrictions and modelling them on the Raiffeisen system by opening the membership to all, irrespective of whether they can contribute towards its funds or not, and giving them power to advance money for the benefit of all rural industries, whether agricultural or non-agricultural, and empowering the societies to use their funds in co-operative buying and selling.

(2) By the establishment of a State Land and Credit Bank for financing the village societies and for advancing money for the purchase of land and for freeing the small holdings from existing liabilities.

April 28th, 1914. W. A. DE SILVA.

CO-OPERATIVE CREDIT IN THE UNITED PROVINCES.

The example of western countries shows that co-operation is bound sooner or later to raise the moral character not only of the members but of their neighbours. Cases are now numerous in our societies where in a village whole castes as well as individuals have given up drinking, gambling and other vices that rendered them ineligible for election. The society at Shahpur in Benares, which has been favourably noticed in successive annual reports, is composed mostly of Bhars, a tribe locally noted for its criminal propensities. Other villages reputed for the bad livelihood of the residents are making strenuous efforts for the establishment of societies. In many localities elementary schools are maintained by a grant from the profits of the society or by a special levy amongst the members. Sanitation and medical relief have also been taken up in some cases. Many *panchayets* stock a supply of quinine for the use of the members and their families. Petty disputes amongst members, of a civil or criminal nature, are now usually referred to the *panchayet*. Extravagant expenses at marriages, funerals or festivities have been much curtailed. Many villagers have told me that formerly they spent more money than they could afford on such occasions to avoid local odium. Now they can safely say that they are not permitted by the *panch* to indulge in ruinous hospitality. The policy followed of discouraging caste or sectional societies in villages has borne very good fruit. In the *panchayet* all castes and interests are represented, and hostility between caste and caste is disappearing. As a local inspector has reported, a Brahman *sarpanch* has no longer the slightest hesitation in catching hold of the hand of a Chamar member and securing his thumb impression on the promissory note executed by the latter for a loan.—ANNUAL REPORT 1911-12.

GENERAL.

GARDENS FOR THE POOR.

(*Concluded from Page 340.*)

Small gardening for the poor is on a different basis in Germany. In consequence, doubtless, of the brilliant success attending the French private movement, it has come to pass in a number of German towns during the last three or four years that the Municipal authorities themselves have assigned land for market gardening, instead of cash, to those entitled for relief. This was first done in April, 1909, at Posen. In the suburb Gurtschin there were first rented about 1,800 square yards, which were assigned to seven large families for cultivation. A few loads of manure were given them free, and the seeds they bought themselves. The crops not only supplied the said families with all their vegetables during the summer and autumn, but also yielded a small store for the winter. They drew much more money from the garden than would have been given them in cash, and the town fared equally well, for with a total expenditure of 17 marks (rent) from 70 to 100 marks had been saved in cash assistance. The new arrangement is of even greater value as regards health and education. Naturally in Posen there has been a considerable extension of the successful experiment. It was imitated in Konigsberg, where the Poor Relief Board prepared an acre or so of Municipal land for agriculture and kitchen-gardening, and in May, 1910, divided it into allotments, each of from 80 to 600 square yards. The first experiment was made with 25 married or unmarried recipients of poor relief, a preference being given to widows with children and those who though infirm were not incapable of garden work. The under-letting of allotments is prohibited. Larger tracts of land are to be prepared for the same purpose. Frankfort and Strassburg have also recently come to follow the good example of Posen. Not long ago the town council of Dresden decided to devote provisionally 4,800 square yards, together with the necessary seeds, to the same purpose. A rapid advance in this new small gardening movement will doubtless soon be made in consequence of the following decision of the Third International Congress for Workmen's Gardens (Brussels, autumn, 1910) :—

" Taking into consideration the fact that the poor relief burdens weighing upon Municipalities and charitable institutions are not infrequently to be traced to drink, consumption and the consequent corporeal and moral distress, and that family gardens form one of the most efficient weapons against this distress, the congress expresses the request that Municipalities and poor relief boards shall promote such gardens and assign them to large families, instead of giving cash assistance. The State and Municipalities should be bound to lease to garden societies at moderate rates a part of their land suitable for cultivation."

The same congress also requested the speedy enactment of laws that, like those in France, should render family gardens not subject to mortgage or distraint.

A novel kind of experiment in plot-gardening for unemployed workmen is being successfully carried on in a wretched poor part of the East End of

London. In 1906 the West Ham Unemployed Aid Society obtained permission to use gratuitously three acres of the Gas Light and Coke Company's vacant land in Canning Town for the purpose of granting garden plots to temporarily unemployed workmen. In 1907 two acres were added. Two years later the Mansfield House Settlement took the concern over, and were given the free use of the whole of the Company's vacant land—30 acres. This area is at present divided into 340 plots. The holders have to buy their own seeds, or else they have to repay the price out of the sale of produce. Only vegetables are grown, the vicinity of the gas works having proved detrimental to flowers. The average annual yield amounts to about £5 per plot. In 1912 the management of the Settlement asked for a voluntary yearly contribution of 2*s*., and most of the holders cheerfully responded. Up to then nothing had ever been paid in the way of rent. This kind of gardening gives some work to the unemployed, and enables them to earn at least part of their living.

This principle of putting waste land to philanthropic use might be called a "Columbus egg" in its simplicity, inexpensiveness and usefulness. No wonder it is beginning to be acted upon a larger scale in England and America. Recently I received the fifteenth annual report of the Philadelphia Vacant Lots Association. From it I gather that "the land is prepared, and fertilisers with seeds are supplied annually, at a cost of $5 to the Association for each plot." No rent is charged, but every holder is required to contribute, for what is supplied to him, $1 the first season, $2 the second, and so on, so that a family which continues to cultivate a garden pays in the fifth season the full five dollars.

Encouraged by the good results obtained in the State, the late MR. JOSEPH FELS, the well-known land reformer, called into life a Vacant Land Cultivation Society for London, in 1908, which, according to its fourth annual report, is doing splendid work—materially as well as educationally. An official return of the L.C.C. puts the metropolitan acreage of unused vacant land at 14,000. Part of it would be too expensive to prepare for plot gardening, but there is ample that would need comparatively small outlay. The Society could, if it had the money, very well manage ten times as much as the 60 acres with which, owing to lack of funds, it has to be content at present. It obtains the loan of this land from the owners, letting it in 500 plots to needy men or women of the working classes. It is noteworthy that every sovereign spent by the V.L.C.S. means five times this amount in vegetables for the plot holders. "Recognising the value of the aid they receive, and aware of the fact that the Society is not adequately supported by the public," most of the holders lately volunteered to contribute to the management and seed fund. Some offered to pay as much as 15*s*. a year stating that they "would much prefer doing so to receiving continuous gratuitous aid." Recently a branch society was founded in Birmingham. The report rightly expresses a desire for the "substantial recognition" of its work from public bodies to enable it to effect a large extension of its acreage. I hope that not only public bodies but some public spirited persons of means among my readers will do something substantial for the meritorious work of the V. L. C. S., or for establishing similar agencies in other large towns. There are few ways in which money may be spent to better and more lasting good purpose ; for to this discriminating form of help the Pauline aphorism certainly applies : "Faith, Hope and Charity, these three ; but the greatest of these is Charity."—LEOPOLD KATSCHER in GARDENERS' CHRONICLE.

THE WAX PALM

A New and Promising Cultivation of great importance to all Tropical Planters.

The Wax Palm (Copernicia cerifera) produces the valuable Carnauba Wax; this tree accommodates itself easily to climate and soil and can be interplanted with cotton, food or fodder plants, green manure, etc. To Coffee, Cocoa, Rubber, etc., it offers shade, but at the same time it allows sufficient light and air to pass to the trees below. Therefore the Wax Palm is not only a very useful but also a profitable acquisition.

For trials we supply on receipt of 7 shillings and 6*d.*, 75 seeds as sample of no value under registration, postage paid; on receipt of £ 4, we forward 10 lb. seeds by parcel post, postage paid to all countries.

Detailed Instructions for Cultivation with Every Order:—

GEVEKOHT & WEDEKIND, Hamburg 1.

COIMBATORE CONFERENCE.

The proceedings of the Board of Agriculture in India which held its Annual Conference in December last at Coimbatore have just come to hand.

Under the section dealing with "The Best Means of Bringing Improved Methods of Agriculture to the Notice of Cultivators" the following note appears in the report of the Committee:—

"MR. DRIEBERG, Director of School Gardens in Ceylon, gave the Committee an account of what has been done in this direction in Ceylon, and the Committee recommend that he should be asked to record a note on the subject as an appendix to this report. A first effort to establish school gardens in Burma has aroused great keenness, and the parents have co-operated extensively in making such gardens a success."

The memorandum referred to is given below:—

The following note will give an idea of what we have done in Ceylon for the sons of cultivators with a view to better equip them for their future life, and the lines upon which the work so begun is developing.

About 10 years ago it was decided to adopt a scheme for establishing gardens in connection with Government vernacular schools in order to give a practical side to the ordinary school curriculum.

A start was made with a selection of half a dozen schools provided with facilities for gardening, viz., a suitable piece of land and satisfactory water supply.

Beginning in this small way the scheme gradually developed till to-day we have 250 school gardens distributed throughout the island.

The scheme may be briefly described as follows:—

About an acre of the land attached to the school is set apart for the garden, where no crown land is available the District School Committee (of which the Revenue Officer is Chairman) provides the required area by purchase or long lease, meeting the cost from a local fund.

The cost of wire for fencing (say Rs 25) and of garden implements (say another Rs 25) is met from the vote for school gardens allowed by Government, but the cost of erecting the fence and where necessary of providing a water supply is borne by the local authorities.

The gardens are controlled by a superintendent with the assistance of three inspectors (each of whom is in charge of a third of the island) who are constantly on tour, keeping the work going on proper lines.

The garden itself is generally divided into three sections—an ornamental section in front of the school, and economic section consisting chiefly of vegetable plots occupying the two sides and a fruit section in the back ground.

The necessary seeds and plants are mainly supplied from a stock garden in Colombo where it is sought to exemplify all that is expected of a school garden and where new products are first tried before being sent out.

The actual work of the school garden is done by the school children and no paid labour is allowed. This work is generally done in the early morning before regular school work begins: the garden being divided up among the different standards and the children working under the supervision of the teacher, his assistants and monitors.

At first two difficulties were encountered: the prejudice of parents against their children engaging in manual labour and the inexperience of teachers.

The former soon gave way before the spontaneous interest which the children displayed in the outdoor work and the healthy competition which sprang up between different classes and between one school and another. The latter difficulty was minimised by the practical instruction imparted by the trained men who visited the gardens.

A course of nature study and elementary science combined with practical outdoor work was subsequently made part of the curriculum of the teachers under training so that now teachers are better qualified for their duties under the new order of things.

A further development is about to take place by providing a short special course of agricultural training for teachers after their course in the normal school, while from next year a set of agricultural readers will be introduced into Government vernacular schools. Last year school gardening was included in the government educational code as a subject for grant so that it may be expected that all private schools will take up the new movement.

As a result of the operation of the scheme for school gardens the surroundings of our schools are being altered beyond recognition. Originally bare and uninviting, they are now bright and attractive.

The outlook of the village school boy is being widened and his mind given that bent which is appropriate to him as a unit in a rural population; while through his daily experience in the growing and tending of plants he acquires a knowledge of the fundamental principles of agriculture. Incidentally the school garden is a means of introducing new plants—chiefly additions to the food supply—which the children help to disseminate in the villages.

The produce of the garden is shared by the teacher and the boys while there is also a vote for prizes for the best gardens—half the award going to the teacher and the other half being distributed among the three best workers.

It will thus be seen that we are taking full advantage of the opportunity of working through village school children (the most promising material) for the benefit of the rural population and I think it will be admitted that the scheme is calculated to better equip these boys for the life before them so that they would enter upon their business with a wider outlook upon the world and with a foundation of technical knowledge upon which to build.

Within the next few years it is intended to establish a number of agricultural schools throughout the island, so that on leaving the ordinary village school the boys may have an opportunity of continuing and so to speak specialising in agriculture. It is for these schools that we are getting four young men trained at the Poona Agricultural College.

TEFF GRASS—ERAGROSTIS ABYSSINICA.

G. B. BROOKS.

A short time ago a quantity of Teff seed was introduced by the Department of Agriculture, and is being tested at the various agricultural institutions, samples also being sent to selected farmers in other districts. It is expected that the results from these tests will be known shortly, and will be published in this Journal.

Frequent mention of this grass has been made recently in agricultural and other publications, which have also in several instances advertised it for sale. The result is, that in my travels amongst farmers it has been found that many have been induced to purchase seed for the purpose of giving it a trial as a pasture grass.

It may be pointed out that this grass is not claimed to be of any great value for grazing purposes. It is essentially a hay crop and, moreover, practically an annual, which fact renders it useless as a permanent pasture grass.

It is a heavy and free seeder, and will undoubtedly reproduce itself by "shedding," if allowed to stand over or ripen before harvesting. Some caution should, therefore, be exercised if planted as a hay crop previous to lucerne, maize, or sugar-cane, to see that it is cut down before seeding. It is a very rapid grower, coming to maturity in a few weeks, so that if a spell of wet weather were experienced to prevent cultivation, it would be likely to choke out these crops.

Teff grass is a native of North-east Africa, grown principally for food, the small grains being made into bread.

The stem is fine in texture, attaining a height of from 2 to 4 feet. As it is a warm weather crop, planting should be carried out from September to February, the amount of seed necessary to sow an acre being from 3 to 7 lb.

The land should be put into good tilth previous to planting. The seed, being small, should be covered lightly either with lever or brush harrows and then rolled.—QUEENSLAND AGRIC. JOURNAL.

THE OIL PALM IN FRENCH GUINEA.

L. NICOLAS.

Experiments on the preparation of palm oil from *Elæis guineensis* by the native method during 1911-12 have given the following results :—

Total Yearly Production from 590 Trees.

FRUITS.		
No. of bunches of fruit	2,521	
Total weight	44,300	lb.
Total weight of fruit	26,570	,,
Average weight of fruit per bunch ...	10·1	,,
OIL.		
Total weight of oil extracted by native method	2,073	lb.
Average weight of oil per bunch ...	0·82	,,
Percentage of oil extracted from fruit ...	8·1	
PALM NUTS.		
Total weight of palm nuts obtained ...	16,208	lb.
Average weight of palm nuts per bunch ...	6·43	,,
Percentage of palm nuts in the fruits ...	63·4	
KERNELS.		
Total weight of shelled kernels	4,528	lb.
Average weight of kernels per bunch ...	1·80	,,
Percentage of kernels in the fruit... ...	17·7	
Percentage of kernels in the palm nuts ...	27·9	

Analysis of the results obtained from the harvests at different times of the year shows considerable variation in the yield of oil and nuts. In May the yield of fruit is much less than in October and January, but the percentage of fruit per bunch and the percentage of oil obtained from the fruits is much higher, whilst the percentage of nuts in the fruits is much lower.

Annual Returns from a Plantation of 590 Trees.

	£	s.
2,073 lb. of oil at nearly 3*d.* per lb. at (Conakry)...	24	5
4,528 lb. of kernels and 2,200 lb. of kernels gathered from the ground beneath the trees, making a total of 6,728 lb. of kernels at about 1½*d.* per lb. (at Conakry) ...	42	8
Total income from 590 trees ...	66	13

Corresponding to a return of 2*s.* 3*d.* per palm tree in bearing.—MONTHLY BULLETIN.

THE PROPERTIES OF BACTERISED PEAT.

Recent investigations have shown that peat when subjected to the action of bacteria becomes transformed into a manure of considerable value. The treatment required to bring about this result was devised by PROF. BOTTOMLEY, and consists in three stages. In the first stage the crude peat is acted on by certain bacteria, and as a result of that action large quantities of "humates" are liberated. In the second stage the humated peat is

sterilised by heat, and in the third stage it is treated with a mixed culture of nitrogen-fixing bacteria (*Azotobacter chroococcum* and *Bacillus radicicola*). It is claimed that the sterilised humated peat encourages in a marked manner the activities of the nitrogen-fixing organisms, and that as a result the amount of soluble nitrogen-compounds is increased during the third stage of the process.

The foregoing facts are recorded with some detail in the GARDENERS' CHRONICLE (October 25th, 1913, pp. 290 and 295); the new observations made more recently and described by PROF. BOTTOMLEY in a lecture before the Royal Society of Arts on Wednesday, March 11th, are destined, if they are established, to prove of considerable importance both to science and practice.

Briefly, these new facts are that extremely small quantities of a watery extract of bacterised peat are potent stimulators of plant-growth. For example, it is stated, on the authority of DR. ROSENHEIM, who carried out the experiments, that plants treated twice with the water extract of 0·18 gram (= 1/150 oz.) respond very readily to the treatment and grow away from untreated "control" plants.

If the result of other more extended and similar experiments is to confirm the correctness of this observation we shall be face to face with a discovery of prime importance: for it is well nigh certain that this growth-accelerating effect of the extract cannot be brought about by the nitrogenous or other ordinary substances contained in that extract. The actual amounts of nitrogen—and of phosphorus—contained in 1/150 oz. of the bacterised peat must be extremely small; far too small as it would seem, to produce a marked increase in the rate of growth of plants potted in ordinary garden soil. To account for the phenomenon DR. ROSENHEIM has suggested—albeit but tentatively—that bacterised peat contains substances similar to those discovered by animal physiologists in various foodstuffs. These substances—known as vitamines or accessory food substances—are held by physiologists to play a fundamental part in animal nutrition. Without their presence foodstuffs, no matter how rich they may be in the ordinary food materials—proteins, fats and the like—fail to nourish, and the animal, deprived of the accessory food substances, languishes and dies.

These accessory food substances are derived by animals directly or indirectly from plants, and the well-known incidence of scurvy among sailors and others deprived for a long time of fresh vegetable food may be attributed, in the light of recent research, to the absence from the diet of accessory food substances. A further illustration of the vital importance of these substances is supplied in the disease known as beri-beri. It has been shown that this disease, which is widespread and increasing among Eastern people who live on rice, is due to the fact that as the result of the introduction of the modern steel roller the husk is removed during the preparation of the rice grain. It is in the husk that the vitamines are contained, and it is the lack of these accessory food substances that accounts for the disease of beri-beri. By adding the husk to the polished rice or by the addition of vitamines from other sources, e.g, from *Phaseolus mungo* L., the disease is prevented. Rickets, another malady which has long been ascribed to a disordered and poor nutrition, is now attributed more precisely to the deficiency of vitamines in the restricted and monotonous diet of the poor.

The observation that a water extract of bacterised peat containing so little solid matter as 30 milligrams acts as a stimulator of plant, growth has led DR. ROSENHEIM to make the suggestion that no less than in animal nutrition, so in plant nutrition, obscure accessory substances may play a part. The suggestion is one of great interest, but it must be received as it is given with proper caution.—GARDENERS' CHRONICLE.

THE SELECTION OF TEA.

MESSRS. BERNARD & VAN LEERSUM, of the Experiment Station for Tea, Java, have just perfected a method for disinfecting the seeds of the tea plant and separating those possessing only a low germinative power. The disinfection is accomplished by means of a one per thousand solution of corrosive sublimate, and its chief object is to preserve Java from two pests which do not yet exist in the Island, but which cause damage in British India : *Exobasidium vexans*, which produces blister blight, and the green fly (*Chlorita flavescens*).

The seeds after being taken out of the corrosive sublimate bath are plunged into pure water with the object of washing them and separating those that float and which form class (a). The seeds that are heavier than water are then placed in a 25 per cent. solution of sugar : some float (b) and the others sink (c). After the sugar bath the seeds are washed again in pure water.

The (a) seeds have a low germinative power ; they are put into a germinator and those which sprout are added to the (b) seeds, which are sown in a nursery ; then the most vigorous plants are selected. As for the (c) seeds, the best, they may be sown at once where they are to remain. This method is very rapid, simple and cheap, and it has given excellent results

[It is interesting to note that Java has adopted the method which it was. proposed to employ in Ceylon but which was abandoned in deference to Indian criticism.—ED. T. A.]

GRAFTING.

In order to improve the quality of existing plantations, the writers have devised a method of grafting which gives 70 per cent. of successful grafts, and this with still inexperienced hands. The stock must be between 3 and 5 years of age and the best time for the operation is the beginning of the rainy season. The graft that has yielded the best results is one in which a T-shaped incision is made in the bark of the stock. The scion is a strong shoot bearing three or four buds and somewhat lignified at its base ; its lower extremity is cut to a level about 1¼ inch in length, and inserted into the T-shaped incision, the sides of which are then drawn together and the whole is carefully bound.

The question of decorticating the tea seeds used for sowing is not completely settled ; it seems, however, that it is preferable to crack the tegument without removing it from the grain.—MONTHLY BULLETIN.

PRODUCTION OF ALCOHOL FOR MOTOR FUEL.

According to a recent discussion* it would seem probable that a new field of industry will be very soon opened up in the Colonies to meet the rapidly growing demand for motor fuel. Last year Great Britain alone consumed about 20,000,000 gallons more of petroleum spirit than was used in 1912 whilst it is calculated that American requirements for motor spirit must be somewhere in the neighbourhood of 1,500,000,000 gallons per annum, and this figure is likely to increase each year. It is true that new oil fields are being developed, but it is equally true that old fields are getting exhausted, and the ever-growing price, not only of motor spirit but also of lubricating and lighting oil, makes it fairly evident that production will not be able to keep pace with demand in the near future.

* See JOURNAL OF THE ROYAL SOCIETY OF ARTS, February 6th, (1914)

For petrol, the obvious substitute is alcohol; and on this point the mechanical engineer and the planter come into intimate contact. Already we know that the greatest of the manufacturing industries—with the exception of the metal trades—are directly dependent on the soil. It would not be strange if agriculture is now to play an important part in engineering, and to provide the principal source of energy for mechanical locomotion. Of course the principal consideration at present is whether alcohol could really be an efficient substitute. According to DR. ORMANDY, there seems little doubt that it could. Already, we are told, alcohol can be applied with perfect success in specially designed engines in Germany, where thousands of machines working on alcohol are employed for miscellaneous purposes in and about agriculture. But these engines are primarily of the high-compression, slow-running type, and the employment of alcohol for the fast-running motor-car type of engine has not yet received systematic attention. Nevertheless it has been definitely established that a mixture of alcohol and benzene can be used in fast-running engines of present day construction, and it is further a fact that alcohol, chemically and physically, possesses properties which should enable it, under proper conditions, to yield superior results as a fuel to petrol. A discussion of the relative merits would be out of place in the present article; but we may strengthen the soundness of our contention that a demand for alcohol fuel will spring up, by quoting the following concluding passage from PROFESSOR VIVIAN LEWES' book*: 'The world's stores of petroleum, coal, and shale are all being rapidly depleted, and in the not very distant future it will be to alcohol that we shall have to turn, and it will then be found that alcohol, denatured with 10 per cent. of benzol and tinged by a trace of aniline dye will give a motor spirit at once safer, more pleasant in use, and sweeter in exhaust than the petrol, of to-day; and that although the calorific value of such a mixture is only 0·6 of the value of petrol, the smaller amount of air needed for its combination, the increased explosive range of the mixture, and the higher compression that could be used in the cylinder, all combine to make it the ideal motor spirit, and one about which no doubts can be raised as to the possibility of future supply.'

The passage ends, it will be observed, with a statement of no little interest to the agriculturist. What are the possibilities in the direction of alcohol production for fuel in the Tropics? For local consumption, at all events, the possibilities are very great, and this phase of the question may be considered first. In regard to the utilization of alcohol as a by-product on the cacao estate, credit is due to MR. HAMEL SMITH for urging the importance of this matter. He writes†: 'In theory there is no reason why a well organized cacao estate should not produce its own spirit, if not its own vegetable oil as fuel for any power required in the sweating or drying houses, or for tractors transporting the produce.' The same author also quotes at considerable length in the book referred to, passages from several important articles recently published on the utilization of alcohol as a fuel—information which will repay study by those who are interested in the subject under consideration. To MR. HAMEL SMITH is also due credit for urging coconut planters, instead of losing the milk contained in the fruit, to ferment it, thereby producing alcohol. The same thing applies in the case of estates which have Manila and sisal fibre refuse. On the banana plantation, MR. FAWCETT‡ has recently shown there is great scope before the production of alcohol. 'In all the [banana] exporting countries put together there are

* Oil Fuel. By PROFESSOR VIVIAN B. LEWES, F.I.C., F.C.S. (1913).

† The Fermentation of Cacao. Edited by HAROLD HAMEL SMITH (1913).

‡ The Banana; Its Cultivation, Distribution and Commercial Uses. By W. FAWCETT B.Sc. (1913).

probably as many as eight million bunches that annually fail to come up to the high standard rightly insisted upon by the shippers.' This is the material which, in part, at any rate, could be used for the production of alcohol. It would seem that 100 kilogrammes of banana meal washed with malt extract and then fermented with yeast yields 47·8 litres of alcohol.

But it is in the sugar estate that the production of alcohol offers the greatest commercial possibilities. The manufacture of rum is of course one profitable way of using molasses. But it is a question whether molasses might not be used economically in the factory and on neighbouring estates for fuel purposes by its conversion into alcohol. The central sugar-cane factory, like the beet factory, possesses special advantages in regard to the production of alcohol, since distillation plants are available together with proper heating arrangements and what is equally important—chemical control. Moreover, it must be remembered that at the present day there are difficulties in the matter of disposing of molasses as such, so that a new and profitable way of utilizing this by-product is really urgently required.

The production of alcohol thus far considered has been for fuel purposes on the estates or in the factory. But it is quite possible that in the large tropical colonies it might pay to manufacture alcohol for transport purposes. This subject has already received definite attention in regard to South Africa for instance ; but in the Federated Malay States where the roads are good and in West Africa and in British Guiana where they may be some day, the idea of establishing a definite industry of alcohol manufacture is worthy of consideration. Of course, in Germany, which is remarkably deficient in sources of oil fuel, many of the agricultural districts produce abundant crops of potatoes and beets for the production of alcohol for fuel purposes. Proposals are now being made in England for following suit in this matter, and it is estimated that, with a remission of the Government duty, alcohol could be retailed to the consumer at 1*s.* per gallon as against about 1*s.* 7*d.* per gallon for petrol.

The question whether it would ever be possible for the Tropics to grow crops systematically for alcohol production, that is to say for export purposes, is difficult to answer at the present time. A great deal would depend upon prices, fiscal arrangements and transport. For the present it is almost sufficient to urge each tropical country to look after itself and to endeavour by utilizing by-products in sugar, cacao, banana and fibre cultivations to provide itself with motor fuel for local consumption. In regard to sugar, in particular, emphasis may be given to the possibilities before the utilization of molasses for the production of fuel alcohol.

Having referred to the systematic cultivation of crops for alcohol production, it would be an omission to neglect the chemical aspects of the subject. It has been said that it would be a wrong course to use the land for the production of raw materials for alcohol-making, for fear that humanity might thereby be deprived of food and clothing. There is something to be said in favour of this contention, particularly in connexion with certain districts ; but in the production of crops for alcohol-making the soil need not be depleted unduly, for the residuals containing essential mineral elements of plant and animal food can be replaced. It is more a question of occupation than exhaustion, and if it will pay to grow crops for alcohol-making it may be done without any undue violation of chemical ethics. As we have said, the most promising lines of activity lie in the direction of the utilization of by-products ; and when the demand for motor tyres begins to wane from the want of petrol to drive them round, then the sugar-growing colonies, to some extent those producing other tropical produce, may be able to help sister industry by producing alcohol for fuel. In doing so they will also confer a great benefit on the general public, and incidentally make a profit out of valuable material, which is now, to a large extent, being wasted.—AGRICULTURAL NEWS.

By Appointment

FISONS' (IPSWICH) FERTILIZERS

By Appointment

For Tea, Rubber, Coffee, "The Best in the World." Sugar, Tobacco, &c.

[illegible]

SHEEP DIPS DISINFECTANTS INSECTICIDES.

Full Particulars sent post free on application to

Joseph Fison & Co., Ltd.,
Ipswich, England.

Fertilizer Manufacturers to His Majesty the King.

GARDENING AND GOOD SEED.

Complete success in vegetable gardening is not possible without good seed. Expert gardeners have always exercised great care in procuring good seed, although the significance of the subject has not been fully appreciated until recently, when the Pure Seeds Bill was introduced by the present Minister for Agriculture. "If," as Henderson states in "Gardening for Profit," "there is one thing of paramount importance in vegetable gardening it is—purity of seed." And he spoke from his experience of a long and active life as a commercial grower.

Good seed must meet five requirements:—1. It must be true to name and not mixed. 2. The seed must produce the best type of the variety in question. The strain is by far the most important factor for consideration in obtaining seeds, although it has received comparatively little attention. 3. The seeds must be viable. That is, a high percentage should be able to grow under favourable conditions. 4. They must be free from weeds. 5. They must be free from impurities such as grit, sticks, or other foreign materials.

In the United States seed supply houses were established in [illegible], and these have since grown to mammoth establishments. The seed business is highly specialised, requiring the services of experts who understand the principles of plant breeding. The most reliable firms maintain extensive trial grounds where the seeds are tested before being sold. It is a means of protecting both the dealer and the buyer.

With respect to seed guarantees, several States in America have enacted laws to regulate the seed trade. Such laws have undoubtedly proved very valuable, but it is a very difficult matter to control by law. Legislation is imperatively needed more for farm seeds than for garden seeds, as impurities are seldom found in the latter. The difficulty with the former, even with reputable firms, is that errors in labelling may occur and incorrect weather may affect the vitality of the seeds and unjust penalties might be imposed if legislation were too severe in this matter, as even the most reliable dealers may unintentionally make mistakes. Rules and regulations for certain seed testing have been adopted by the Association of American Colleges and Experiment Stations.

The life of seeds depends upon: 1. The kind of vegetables. 2. The conditions under which they are grown. 3. Thoroughness of curing. 4. Storage conditions. In some years seeds lose their vitality more rapidly

than in others. The figures in the following table relative to the longevity of vegetable seeds are conservative, for it is not best to place too much reliance upon tables of this character; the only certain means of determining the vitality of seeds is to make germination tests.

PROFESSOR WATTS then supplies the following table showing the maximum ages of properly cured and stored vegetable seeds when they will be likely to germinate satisfactorily:—

	Years.		Years.		Years.		Years.
Artichoke	2	Celery	2	Lettuce	4	Pepper	3
Asparagus	2	Cucumber	5	Muskmelon	5	Radish	2
Bean	3	Eggplant	5	Okra	4	Salsify	2
Beet	4	Endive	2	Onion	1	Squash	3
Cabbage	3	Kale	2	Parsley	1	Tomato	5
Carrot	1	Kohlrabi	3	Parsnip	1	Turnip	4
Cauliflower	4	Leek	3	Pea	3	Watermelon	5

The following table, showing the average percentages of germination of one-year-old seed when planted under proper conditions is given by RALPH L. WATTS, Professor of Horticulture in the Pennsylvania State College, in his book on "Vegetable Gardening," 1912:—

	Per cent.		Per cent.		Per cent.		Per cent.
Asparagus	90	Celery	60	Okra	80	Salsify	75
Bean	90	Corn, Sweet	85	Onion	80	Spinach	80
* Beet	140	Cucumber	85	Parsley	70	Squash	85
Cabbage	90	Egg plant	75	Parsnip	70	Tomato	85
Carrot	80	Lettuce	85	Pea	90	Watermelon	85
Cauliflower	80	Muskmelon	85	Radish	90		

—QUEENSLAND AGRI: JOURNAL.

ELECTRICITY AND PLANT PRODUCTION.

It is desirable to make clear the scope of this article at the outset. There are many ways in which electricity may serve agriculture and horticulture in the future. Here it is only intended to discuss its possible direct application to increase or accelerate the production of a crop by modifying the electrical conditions under which that crop is normally grown. This is an application of electricity which is still in an experimental stage, but a brief description of the progress recently made will show that the next few years may enable a definite verdict to be pronounced as to its commercial practicability.

It is now a very long time since the first experiments upon this problem, modern though it seems to be. Perhaps some day it may be desirable to write the history of the investigation, but at the moment I think we may leave this pioneer work upon one side. As I shall hope to show later, the result of recent practical trials of this treatment has been to demonstrate that the significance of many of the statements of the earlier workers will have to be re-considered. This is not the occasion for such a critical historical survey, so leaving aside this earlier work, which makes a fascinating chapter in the history of the science, we will proceed at once to a discussion of the modern methods of applying electricity to plant growth.

* Botanically a fruit, often containing more than one seed.

At the present time in nearly all the large scale trials the electricity is applied as a discharge into the atmosphere above the plants. This simply modifies the electrical charge which is already reaching the plants from this source. Usually the air above the growing plant is charged to a positive potential. This charge is continually leaking away through the plants to the ground, and is continually renewed from the upper layers of the atmosphere. It is extremely variable, but in normal weather is comparatively small, not more than a few hundred volts at a point about a yard above the plant. But in thunder weather, when the electrical charge increases, the potential is greatly increased and the current leaks away more rapidly to the ground.

Now, the method of electrical discharge employed in these experiments generates a very high potential of electricity by means of a coil and a series of rectifying valves, and then charges a system of thin wires spread above the plants at intervals of ten to fifteen feet, to this high potential of some 50,000 to 100,000 volts. The wires are so highly charged that though raised upon Larch poles to a height of from ten to fifteen feet above the plant, they continue to discharge sufficient electricity into the air to raise the electric current passing from the air to the plant to about ten thousand times its normal value.

The electrical apparatus for developing these high-tension currents has been designed by MR. J. F. NEWMAN, with the advice and help of SIR OLIVER LODGE, and it can easily be rendered efficacious for the supply of electricity to quite large areas.

The greatest practical difficulty on the electrical side is the adequate insulation of the system of wires which are kept at such a high electric potential. This is a very necessary precaution to ensure that the current shall be leaking away off the thin wire stretched above the crops at intervals of about ten to fifteen feet, rather than elsewhere. These difficulties have been overcome to an extent that shows that electrical problems in the way of practical application of the discharge can be solved. We may now, therefore, turn our attention to the experiments devised to ascertain whether such practical application would be advantageous.

The investigator who wants to apply electricity in the field is confronted with one difficulty. He has no adequate knowledge of the scientific side of the problem upon which to base his plan of treatment. Laboratory investigations are now in progress which may in time settle the broad principles of treatment, but the effect of the practical application of the discharge upon a large scale had to be demonstrated before it was realised that these problems called for solution. At present the times of applying the discharge, the strength used, the duration of discharge, are all matters that have to be decided empirically. The final answer to the practical problems involved will only be obtained when the practical control of the field experiment is based upon principles thought out and thoroughly tested by previous work in the laboratory. With the aid of a grant from the Development Fund, administered through the Board of Agriculture, these problems are now being attacked in the laboratory at the University of Leeds. Some points have been cleared up, but there is still a great deal of work to be done, and until it has been done a general discussion of principles is premature.

In the meantime, large-scale field trials have also been in progress, carried out in part by the University of Leeds, and also through the energy and interest of private individuals, especially of MISS E. C. DUDGEON at Lincluden, Dumfries, MR. WILLIAM LOW at Balmakewan, near Montrose, and MR. RAYMOND BOMFORD at Salford Priors, near Evesham. These field trials have lately entered upon a new phase, and the most useful purpose this article can serve will be to bring out this point of view and discuss its reference to the practical problems involved.

When funds were available for making large-scale experiments at the University Experiment Farm at Garforth, it was immediately decided to direct attention in the first place to the methods of measuring the actual strength of the electrical discharge distributed over the plants. It was obviously no use to weigh crops from experimental and control areas with great care, unless the figures could be contrasted with significant figures as to the electrical comparison between the two areas. To take an extreme case, an increased case of 50 per cent. would be of but little help to the experimenter unless it would be ascertained what were the actual electrical conditions accompanying this increased yield. An attempt to repeat this result might be made with different electrical quantities and an entirely different yield obtained.

It took some time to devise suitable methods for measuring these electrical conditions, but the difficulties, which were considerable, were eventually overcome, and a paper will shortly be published elsewhere describing these methods and drawing certain conclusions from their use up to the present. One of the results is of very great significance. It has been demonstrated beyond doubt that the *effect of the electrical discharge is by no means confined to the area directly beneath the wires.* It will be seen how seriously this conclusion affects all the field trials made up to the present. Perhaps this may be made clear by reference to a specified experiment in which the new facts learnt about the distribution of the discharge entirely alter the conclusions that might at first sight be drawn from it. It should be first stated that on a windy day the discharge does not spread equally on all sides of the electrical area. It is carried by the electrically charged particles of the air, and therefore, of course, spreads very little against the wind, and a very long time in the direction of the wind. In the light of this knowledge let us discuss the field experiment carried out at Dumfries in 1912.

This experiment was made upon Potatoes (British Queen), and it was arranged that the crop should be lifted and weighed in tenth-acre plots from the whole of the electrical and control areas.

As these two areas totalled four acres of ground, this provided that any errors due to other local conditions, such as soil conditions, could be gauged very accurately. This experiment was carried out in complete ignorance of the facts about the distribution of the discharge stated above, and the experimental area was arranged in four plots together forming a square with the controls diagonally opposite each other. The idea in so distributing electrified and control areas was, of course, to equalise as far as possible differences in soil and exposure between the different ends of the field.

When the crop was lifted and weighed it was found that practically no difference existed between the yield from the electrified and control areas. At first sight this seemed a decisive proof that the electrical treatment had no practical value; the conditions for growing were good, and the crop on the light soil were excellent, averaging 14 tons to the acre. But concurrently with these experiments the measurements at Garforth were in progress, and by the time the potatoes were weighed the data to hand from these measurements led us to anticipate that the crop should in any case give a nearly even yield. These measurements had shown the effect of wind in carrying the discharge. Now a little consideration of the arrangement of the plots will show that, in whatever direction the wind might blow, it always carried the charge from an electrified to a control area. Very light winds will carry the discharge the full length of the control areas in these experiments, so that the electrical difference between these four areas was negligible. By our very precautions we were undone, and the results of the year's trials are without significance. This example will suffice to show that experiments

in which weight of crop alone are taken cannot be relied upon: they must be accompanied by figures expressing the electrical comparisons between the two experimental areas. In the light of these facts it would be interesting to review the earlier experiments.

Space will not permit a full discussion, but the two following points may be emphasised. Firstly, the validity of the results obtained with the system of electrical treatment will be greater as the size of the control area increases; secondly, the results will also be more reliable when the discharge wires are nearer to the ground, as this means less spreading of the discharge in the wind.

It should be pointed out that these new facts as to the distribution of the discharge do not point to any impossibility in its practical application; rather the reverse, as they show how easy it will be to arrange for the discharge to cover a considerable area.

But they have considerably increased the difficulties in the way of carrying out crucial experiments which shall finally decide the question as to whether the discharge will produce a sufficiently increased crop to justify its application upon a large scale. To decide this point experiments must be carried out in which the weight of a crop obtained under measured electrical conditions is compared with the weight of a crop from a genuine control area in which the electrical conditions approach closely to those under a norma atmosphere. The rest of this paper will describe the progress that has been made in obtaining this quantitative comparison between known electrical conditions and a genuine control area.

For this purpose it was necessary to standardise the methods of electrical measurement, so that they could be used in all field experiments. These measurements can now be carried out by convenient portable instruments with considerable ease, and will give a very fair representation of the electrical conditions of different points within an area. In subsequent years it is hoped that in all the large-scale experiments in Great Britain these measurements will be made so that the value of any difference in yields may be assessed in the light of valid electrical data.—J. H. PRIESTLEY IN GARDENERS' CHRONICLE.

THE NATURAL INFECTION OF CALVES WITH TUBERCLE BACILLI.

The writer (Chausse) submitted to careful examination 56 calves destined for the slaughter house and suffering from typical tuberculosis, with the object of ascertaining the principal way by which the tubercle bacillus had entered their bodies. Of the 56 animals, 44 had typical tubercles in the lungs; while all the other organs, including those of digestion, were intact. The infection then must have followed the respiratory canal. Material from the intestinal glands of 11 animals was inoculated into guinea-pigs and produced tuberculosis only in one case. But in this case also it was not certain that the corresponding calf, besides lung tuberculosis, had not intestinal tuberculosis also.

Of the remaining 12 calves, 8 showed decided tuberculosis of the liver and its glands. In these cases, the infection must have taken place before birth, which seems all the more probable as the stage of the disease was much more advanced than in the pulmonary tuberculous calves. The four last calves had severe intestinal tuberculosis and had tubercles in the walls of the intestine and in the mesenterial glands, The tubercle bacillus in these

calves had undoubtedly been introduced with their food. In all the calves the glands of the infected organs were much degenerated. The animals infected before birth showed a more advanced degeneration than those infected by the air or food.

The writer concludes from these investigations that the animal organism has always the tendency to oppose a local reaction as soon as possible to any local infection with tubercle bacilli. Consequently the development of the disease proceeds somewhat more rapidly in the calf than in mature cattle. Calves take the tubercle bacillus in the great majority of cases from the air. Nevertheless, infection before birth is not unimportant. Infection by means of the food is much rarer than through the blood. In France the writer found in 6,000 slaughtered calves only one that had been infected by its food. The reason of this may partly lie in the fact that the herds of cows are relatively only very slightly affected by tuberculosis. In pigs, this kind of infection is naturally much more frequent, owing to their very varied food: in 169 pigs that were slaughtered the writer found one animal that had taken the bacillus with its food.

It can therefore be assumed that cows' milk is only in the rarest cases the cause of human tuberculosis.—Monthly Bulletin.

Sales of Produce in British and Continental Markets.

Fibres, Cotton, Grain, Oil Seeds, Hides and Skins, Timber, Rubber, Drugs, Wool, Ores, Mica, Gums, Tea, Cocoa, Coffee, Copra, Sugar, etc., are being regularly dealt in; Keymer, Son & Co., being selling Agents for Estates, Mills and Exporters.

Samples Valued.

Best Ports for Shipments Indicated.

THE MANAGEMENT OF

ESTATES UNDERTAKEN.

Capital found for the development or purchase of valuable properties.

KEYMER, SON & Co.,

Whitefriars.
LONDON, E.C.
(Same address since 1844.)

Cables:
KEYMER, LONDON.

MAIZE.*

It is symptomatic of the change in appreciation of relative values that the RIGHT HONOURABLE LOUIS BOTHA, to whom MR. BURTT-DAVY'S book is dedicated, holds the dual post of Prime Minister and Minister for Agriculture of the Union of South Africa. The fact is significant not only because of GENERAL BOTHA'S keen interest in agriculture, but also because it shows that South Africa is alive to the great problem which lies before it, that of establishing agriculture before the other great South African industry passes into an inevitable, albeit as we hope far distant, decline.

MR. BURTT-DAVY, in his capacity of Government Agrostologist and Botanist in the Department of Agriculture of the Union of South Africa, has had great opportunities for gaining knowledge of the plant about which he writes, and he has used those opportunities well.

That the Maize plant is worthy of the extended treatment meted out to it in this work will be evident when it is realised that maize stands first in productiveness of all crops whatsoever. The total world's crop is no less than 3,875 million bushels, with Oats a far outpaced second (3,532 million bushels,) and Wheat a close third with 3,428 millions, and Rice 3,203 millions, winning easily from Rye and Barley, the annual yields of which are considerably less than half that of Maize. In spite of the enormous production of Maize the world absorbs it readily, and although the United States raises 2,927 million bushels per annum, it consumes almost the whole of that vast amount, and exports only 1½ per cent. This means, of course, that the consumption of Maize by the people of the United States is enormous; as indeed is the case, for no less than 25½ bushels of Maize are consumed on the average by an individual American. Indeed, as the Professor of Economics of Harvard has said, Maize is the leading product of America.

The yield from the Maize industry is estimated as greater by five million pounds sterling than the yield from the manufacture of iron and steel. MR. BURTT-DAVY, with his eye on these facts, aspires to make of South Africa a great Maize producing and exporting country—in fact, the Maize granary of Europe. So far as climate goes, South Africa enjoys an advantage over the States; for the percentage of moisture in the grain exported is five per cent. less than that in American-grown Maize.

Needless to say our knowledge of the origin of this plant is meagre in the extreme. That it originated in America appears to be certain; but from what wildling the Maize has sprung is unknown. Some hold that it is descended from the Teosinte plant (Euchlæna mexicana), and affording some measure of plausibility for this origin is the fact that Teosinte is the only known plant which hybridises with the Maize. Support of an indirect nature is also supplied by the results in later generations of crossing these two plants. As MR. BURTT-DAVY points out, the first and second generations of the cross consist of plants which for the most part resemble Teosinte. This, we think, was to be expected if the Maize has developed by the loss of a considerable number of factors, and if, therefore, the several characters of maize are due to the absence of a number of factors.

From the practical point of view these cross-breeding experiments have proved useless for the immediate purpose for which they were instituted, that of conferring on Maize the greater resistance to chlorosis possessed by Teosinte.

MR. BURTT-DAVY recognises clearly that if South Africa is indeed to become the Maize granary of Europe it must improve its methods of cultivation. He shows us on the one hand that heavy crops may be and are

* Maize: Its History, Cultivation, Handling, and Use with Special Reference to South Africa. BY JOSEPH BURTT-DAVY.

produced in suitable parts of the Union—for example yields of 35½ to 42½ bushels have been obtained on the Government Experiment Farm—and on the other hand that the average yield in the Union is so low as 14-18 bushels. In contrast with this poor result Mr. Burtt-Davy puts the yields obtained in America—where good farmers grow 75-100 bushels of Maize per acre, and where without manure the average yield is half as much again as the average in South Africa. Nothing is more impressive in Mr. Burtt-Davy's comprehensive account of the Maize than the description of the amount of systematic labour which has been and is being devoted in the United States to the further improvement and increase of the crop. It is in applying such labour and system that the author hopes to do for South Africa what the many workers and investigators have done for America.

That this is in course of achievement is shown by the excellence of the chapters on the "Improvement of Maize by Breeding."

To review the many aspects of the Maize problem treated of in this volume is beyond the space at our disposal, and we must conclude by congratulating Mr. Burtt-Davy on the success of his great undertaking and the South African Government on having the services of such a hard working and able agricultural officer as the author of this work.—GARDENERS' CHRONICLE.

The Cry of the Injured

'TABLOID'
(Trade Mark)
BRAND
FIRST-AID
No. 715
For Planters, Estate-Managers, etc., in the Tropics

When an accident happens you hasten to help the injured. If you have this 'TABLOID' OUTFIT you are equipped with just those things you are likely to need.

No. 715 'Tabloid' First-Aid contains 'Tabloid' Bandages, Dressings, Antiseptics, Plasters, Emollients, etc., etc. Enamelled Metal Casket. Measurements: 7⅝ × 4¼ × 2 in.

Compact
Portable
Serviceable

All Chemists
Price in London, 10/6

BURROUGHS WELLCOME & CO., LONDON
NEW YORK MONTREAL SYDNEY CAPE TOWN
MILAN SHANGHAI BUENOS AIRES BOMBAY

xx 1016

Copyright

THE MANURING OF VEGETABLES AND FLOWERS.

To those who know the excellent results achieved by French horticulturists, the pronouncement of the author that his compatriots in the horticultural world are chary in the use of artificial manures will come with surprise. Yet such is apparently the case, and the purpose of this work is to convert French gardeners from indifference to a proper belief in the use of artificial fertilisers.

If sound argument and the evidence of prolonged and careful experiment can effect this conversion, M. DUMONT will undoubtedly succeed.

The standpoint adopted by the author is expressed with directness and lucidity in the opening chapter. The staple manure for horticultural purposes is humus, and hence the application of dung or some other source of humus must form the basis of every rational system of manuring. The functions of artificial manures are to supply special and necessary plant foods, the mineral salts which, though present in insufficient quantities in humus, are essential for the nutrition of all plants.

M. DUMONT reminds his readers that the philosophy of manuring has passed through three main phases. In the early part of last century the humus theory prevailed. That theory maintained that humus is the food of plants. LIEBIG in 1840 shattered the humus theory and replaced it by the "mineral" theory, teaching that plants feed on the inorganic salts—nitrates, phosphates, potash salts, etc.—which are contained in the soil solution. The shattered theory gathered itself together again, and, affecting a compromise with its rival, gave rise to the "organic mineral" theory, which is held at the present day. As summarised by the distinguished French agriculturist Grandeau, this theory holds that humus is essential for perfect and rapid plant growth, since it makes the ideal environment for the roots. It not only helps to bring the necessary salts into solution and helps to hold them in the soil at the disposal of the plant, but it also serves the no less important function of holding water and absorbing heat. Without humus a clay is sour and a sandy soil is a loose powder. Wherefore the wise gardener digs dung into his ground and adds with the natural manure such mineral substances as his soil lacks and his plants require. Once it is admitted that the role of artificials is to supplement, not to replace, farmyard manure, the way is open to an intelligent and economical use of both. Such a use must be based on a knowledge, which need be by no means profound, though it must be sound, of four sets of facts, namely, those concerning (1) the several amounts of the essential minerals which are contained in a given soil, (2) the average chemical composition of dung, (3) the requirements with respect to mineral substances of different kinds of cultivated plants, (4) the general properties and relative prices of the chief artificial manures. Such knowledge is well within the grasp of every gardener; books such as the excellent treatise under review provide information with respect to (2), (3), and (4), and simple experimentation suffices to determine the chemical composition of the soil. For this purpose direct soil-analyses, although of great value if carried out properly, are not absolutely necessary; plants themselves may be used to make the analysis, and by observing the behaviour in the garden of plants known to be exacting with respect to a given inorganic food substance, potash or phosphoric acid or nitrogen salt, the deficiency of the soil may be inferred. As the great pioneer of plant physiology, BOUSSINGAULT, observed "I prefer the opinion of the plant to that of ten professors."—GARDENERS' CHRONICLE: (Review of "La Fumure raisonnée des Légumes," etc. by R. DUMONT).

THE CAMPAIGN AGAINST FLIES.

Flies are often a real pest to man and domestic animals, especially when they invade stables. The importance of the destruction of flies has even been the subject of a discussion by the Budget Commission of the Prussian Chamber of Deputies, in connection with the removal of the thoroughbred stud from Graditz to Straussfurt, the latter place being infested with flies.

The reasons for destroying these persistent and dangerous insects are well known, and many methods of destruction have been devised; but the writer (Bauwerker) considers that appreciable and durable results can only be obtained by giving up half measures and undertaking an energetic and systematic campaign. Considering the importance of the question, he has thought well to give an account of the methods he has used in the stud under his direction at Eichelscheiderhof, as the results have been very satisfactory. In 1887 when he undertook the direction, the stud was so badly infested by flies that living there was most disagreeable in summer.

He began by hanging up in the stables and all dwellings, without exception, pieces of limed wood, bigger and longer for the stables, thinner and shorter for the houses. For some time the flies had to be removed and the sticks re-limed every day; but when the flies were somewhat reduced this was done only every two or three days. In the earlier years the cost of the lime was considerable (£4 to £4. 10*s*), but it soon diminished considerably.

Various other means were employed. The general conditions were much improved by the drainage of the land round the stud farm, which was rather marshy and provided excellent conditions for flies to breed. Great benefit was also derived from scrupulous cleanliness throughout the homestead, including disinfection of closets and cess-pools, and ventilation of the stables. Flies dislike draughts, whereas the animals, being accustomed to open air when quite young, do not take any ill effects from them.

The flies were also destroyed in places where they like to assemble; a great number were burnt by spirit lamps, when they collected at the approach of winter on the ceiling and walls of the kitchens; in this way many eggs were destroyed before they had time to develop. It was found that whitewashing with the sprayer was an excellent means of destroying the eggs; this was still better when a little formalin was added to the milk of lime. For disinfection, a strength of 2 or 3 per cent. was used; but 1 per cent. does for ordinary purposes.

Formalin is an excellent fly-poison. The writer had good results with a method he got from a paper: this consists in setting out on a plate small slices of bread soaked in a pint of milk to which two spoonfuls of formalin have been added. A pint was found to be enough for large spaces, such as stables; while for smaller places, such as dwelling-rooms, half a pint is sufficient.

Having undertaken a systematic fight, the writer did not neglect any of the usual methods, such as fly papers and fly traps; but he did not find them very successful.

Attempts were made also to encourage as much as possible the natural enemies of flies, especially insectivorous birds. Swallows and martins were the first to be pronounced useful; as it was found that sparrows were preventing their increase in numbers by occupying their nests during their absence, a campaign against these was undertaken, and quantities were destroyed. The number of swallows and martins steadily increased, and they now nest all about the buildings.

The increase of starlings was encouraged by putting up Berlepsch nesting-boxes for them. Other insectivorous birds were encouraged in every possible way (planting of pines and fruit-trees, destruction of their enemies: martens, polecats, weasels, squirrels, birds of prey, etc).

Quantities of flies were also destroyed by the large numbers of fowls kept at Eichelscheiderhof.

Thanks to all these measures, the stud-farm has now been very largely freed from the pest.—MONTHLY BULLETIN.

COTTON AT AMBALANTOTA.

(*See frontispiece.*)

The frontispiece of this number is reproduced from a photograph of the cotton recently grown at Ambalantota, in the Southern Province, to which reference was made in the April number of this Journal.

The variety was Allen's Long Staple American Upland. It was planted in October 1912 and picked in March 1913, the yield being at the rate of 1,043 lb. of seed cotton per acre (total area $1\frac{3}{4}$ acres).

The crop was ginned in Colombo and the seed disposed of locally. The lint, sold in Liverpool, realised $7\frac{1}{2}d$ and $9\frac{1}{2}d$ per lb. The expenditure on clearing and cultivation was Rs.48 per acre, the shipping charges, &c., Rs. 60 per acre, and the gross return Rs. 162 per acre, leaving a profit of Rs. 54 per acre. On a larger consignment the shipping charges might be expected to be proportionately less.

T. P

THE RELATION BETWEEN AN ABUNDANT RAINFALL AND THE PRODUCTION OF COFFEE.

PAULO R. PESTANA.

The writer points out a direct, though not exclusive, relation between the rainfall during the months October to March and the yield of coffee in the season two years later. The same relationship has already been observed in Costa Rica. The figures in the table are those of the three principal coffee-producing centres in the State of São Paulo. The grouping of the months into two periods corresponds to the climatic conditions of the State and to the biological conditions of the coffee plant. October is the beginning of frequent rains, which reach their maximum in December and January and diminish towards the end of March. In April begins the cold dry season during which the coffee is harvested, and this terminates in September. Rains during the hot season favour the flowering the following

year and the fruiting of the second year, but during the cold season they are injurious.

Rainfall.				Yield of Coffee.	
Season.			mm.	Year.	Arrobas.
I. *Ribeira Preto.*					
1904-05	October-March	...	1,573	1906-07	3,261,500
	April-September	...	270		
1907-08	October-March	...	905	1909-10	2,497,742
	April-September	...	196		
1908-09	October-March	...	896	1910-11	2,316,154
	April-September	...	293		
1909-10	October-March	...	1,209	1911-12	2,540,230
	April-September	...	229		
1910-11	October-March	...	753	1912-13	2,100,000
	April-September	...	358		
II. *S. Cartòs do Pinhal.*					
1904-05	October-March	...	1,950	1906-07	2,214,550
	April-September	...	511		
1907-08	October-March	...	1,595	1909-10	1,601,472
	April-September	...	321		
1908-09	October-March	..	2,170	1910-11	*1,328,160
	April-September	...	471		
1909-10	October-March	...	1,459	1911-12	1,403,300
	April-September	...	523		
1910-11	October-March	...	1,061	1912-13	1,232,314
	April-September	...	390		
III. *Botucatia.*					
1904-05	October-March	...	1,124	1906-07	1,026,600
	April-September	...	402		
1907-08	October-March	...	1,103	1909-10	765,350
	April-September	...	201		
1908-09	October-March	...	863	1910-11	493,140
	April-September	...	211		
1909-10	October-March	...	971	1911-12	668,260
	April-September	...	165		
1910-11	October-March	...	842	1912-13	510,000
	April-September	...	477		

—MONTHLY BULLETIN.

* It must be noted that the coffee plants still showed the exhausting effects of the high yield of 1906-07.

NOTES ON PLANTING IN ANTIGUA.

From the Report on the Botanic Station and Experiment Plots, Antigua, for the year 1912-13 it will be seen that the cultivation of cassava in Antigua is in the hands of peasants, and only a limited quantity is grown, and it would seem there is little likelihood of the area planted in this crop in the near future increasing to any appreciable extent. Cassava probably cannot be grown as cheaply there as in some parts of the world where it is grown as a catch crop through permanent plantings. It is however probable that a small trade with America or Great Britain could be worked up with cassava cakes or biscuits. The local cakes are crisp and possess a delicate flavour entirely their own, and if known in those countries would possibly in a short time become popular as an afternoon tea delicacy.

Cassava is put on the market in the form of starch, chipped and sun-dried with peel or without peel; it is also grated, and even the refuse after the starch is extracted is saleable.

The chief characteristics of Columbian cassavas which distinguish them from the West Indian varieties is the low content of hydrocyanic acid which they possess. Determinations on West Indian bitter and sweet cassavas show that they contain about ten times the amount of hydrocyanic acid determined in Columbian varieties.

The results appear to show that after six years' cultivation in Antigua, these varieties have not sensibly altered in respect of their contents of hydrocyanic acid. This fact, combined with the very marked improvement in yield which has taken place during the past three years, indicated that some at any rate of the varieties are worthy of careful attention.

Sesamum might possibly be useful to the peasants in Antigua, for it has been stated that the seeds when parched and eaten with sugar form a nourishing and palatable dish, and that this can be crushed and mixed with other ingredients to form cakes and bread. A plant, the seeds of which can easily be transformed into a breakfast, and one that grows with little difficulty, is worthy of trial, on a small scale at least, by the peasants of the island. As stated in previous reports, the seeds of this plant yield a bland oil sometimes known as gingelly oil; it is used in domestic economy and for adulterating olive oil.

During the different reapings of sweet potatoes it has been noticed that the yield per hole, or in other words, the yield per plant varies in no small degree.

The above appears to be of some significance, and plant selection on this crop was started this year and will be continued in the future. In the first instance it is intended that selection will, generally speaking, be based only on weights of roots of individual plants: possibly in the future other factors will be taken into account. A check on the value of this work will be kept by planting duplicate plots from unselected plants.

This crop is of the greatest importance to the island, and the work done at the Experiment Stations in connection with it, judging by the amount of planting material distributed, is being appreciated; and it is hoped that experiments undertaken to increase the yields of the various standard varieties will add to this.

Local interest in the growing of limes has been maintained during the year under review. During this period nearly 44,000 plants were distributed in the island, this being sufficient material to plant approximately 220 acres. Many of these were used for supplying vacant spaces in plantations recently established.

If this industry is to be a success in Antigua, the greatest care will have to be exercised in choosing sites for new plantings. Speaking generally, the rainfall in this island is too low for lime growing, and when this factor is combined with indifferent soil and a wind-swept situation, very little hope can be entertained of ultimate success. The influence of wind on this crop cannot be over-estimated, and it would be well for the local lime growers to give the question of wind-breaks serious consideration.

Orders have been received at the Botanic Station for several thousand plants of the Bay (*Pimento acris*), and if seeds of this tree can be obtained several experimental areas will in the near future be planted in Antigua. The young trees planted some four years ago at Scotts Hill are now bearing a few seeds, but these will in no way be sufficient to meet the demand. It might be stated that the factor limiting the planting of these at the present moment is the scarcity of seed.

Enquiries have been made at the office in connection with the possibilities of growing papaw (*Carica papaya*) on a commercial scale for the preparation of papain. Orders have been received for a fair number of plants, and during the next few months several experimental areas of this crop will be planted. Little information exists as to the amount of papain yielded per tree, or the best methods for preparing this. Experiments are being conducted to answer some of these questions.

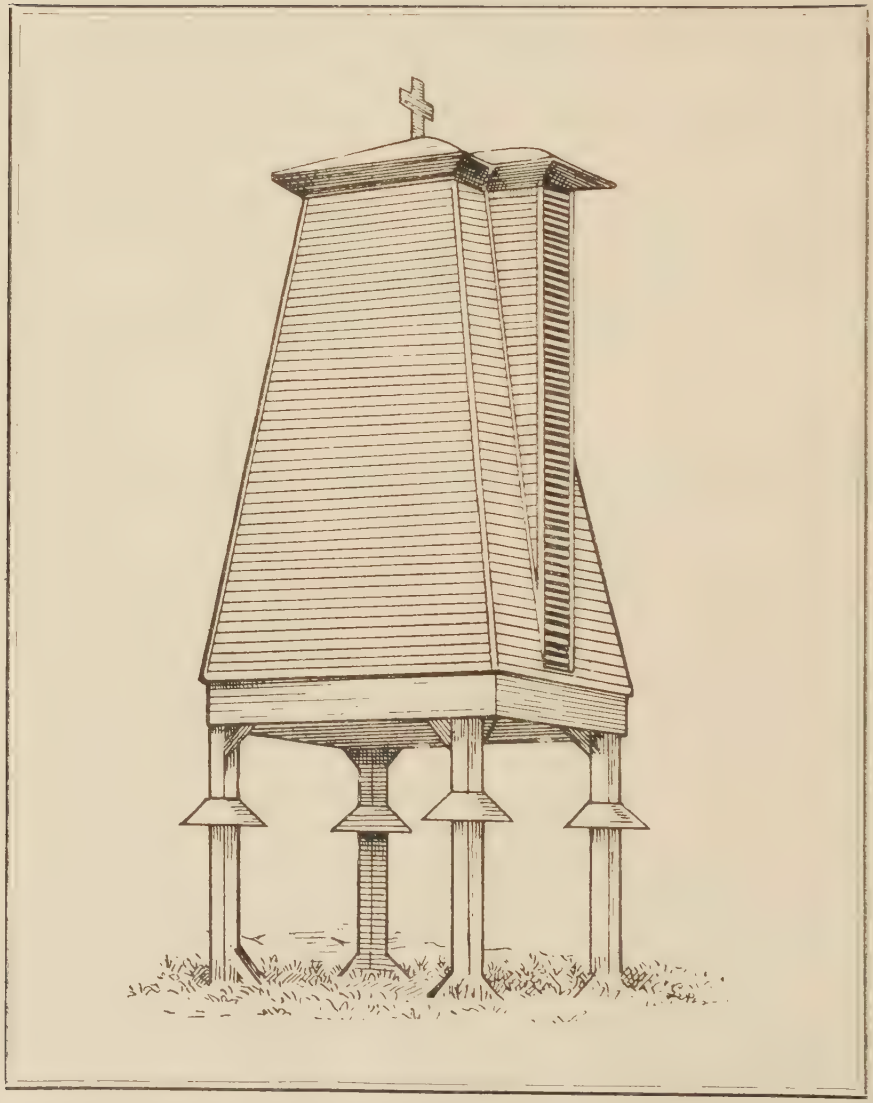
ERADICATION OF MOSQUITOES BY THE CULTIVATION OF BATS.

DR. CHAS. A. R. CAMPBELL.

The writer begins by a brief review of the discoveries made concerning the plasmodia of malarial fever, he then describes how the mosquitoes inoculate their living poison into its human host, and communicates the results of an enquiry made by him by means of hundreds of letters addressed to health officers and druggists in different parts of the Union, in order to ascertain the existence of malaria in the several States. He quotes DR. L. O. HOWARD, Chief Entomologist of the United States Department of Agriculture, who very conservatively estimates the tribute that that Nation pays to malaria at one hundred million dollars yearly.

The greatest enemy of the mosquito, according to the writer, is the bat. For the cultivation and propagation of this animal the writer has devised a kind of wooden tower or roost (see fig.) which offers the advantage of preventing bats, who are obliged usually to fly long distances from their caves in search of food, remaining continuously on the wing for ten and twelve hours at a time, from continually seeking new quarters.

Besides the well known means of defence which the bat possesses against its enemies, viz. its nocturnal habits, its propensity for hiding in dark places during the day, its facility of compressing its body into small apertures, there is the character of the hair covering its body. This last feature is considered by the writer to be a protection against the stings of the Anopheles which during the day also inhabit the same dark places. This protection appears to be due to the peculiar formation of the hair, which is not a round and smooth shaft, but is similar in form to a number of Morning-glory flowers strung on a straw, with the edges of the flowers terminating in points with the belts outward. Possibly the odour of the bat also serves to protect it from mosquitoes. That bats are most remarkably free from disease is evidenced by the fact that they live in caves by the million, hang touching



A BAT ROOST

one another and even to one another in huge bunches, yet people engaged in the business of gathering guano from caves very rarely find a dead bat.

That mosquitoes form the chief diet of bats is certain, ninety per cent. being a conservative estimate. The character and arrangement of its teeth clearly show it to be carnivorous. It will eat pieces out of hams and bacon left in smoke houses. The character of the bites show the pieces to have been torn out, instead of being gnawed, as would be the case if gnawed by some rodent. The mosquito, being a blood-sucking insect, furnishes the bat with an ideal carnivorous diet.

Knowing of a hunter's small cabin some ten miles from San Antonio, where bats were congregating, I procured two large white sheets and spread them on the floor of the cabin about four o'clock in the morning, and awaited their coming. I had however stuffed the roosting places in the hut with rags so they could not roost out of range of the area of the sheets. I watched carefully and counted the proper number going in, and verified the count from the inside of the cabin. I then left them and returned in the evening to count them again when they flew out; after counting the same number going out as came in, I very carefully collected the pieces of guano on the sheets, put them in a little box, and again spread out the sheets to continue the experiment the next day. This was done three times consecutively, and the result is that it averages twenty-six (26) pieces of guano to each bat. These observations were made in the month of November, purposely selected on account of the food of the bats being about at a minimum at this time.

Having ascertained approximately how many times a day a bat dropped guano I took one dropping or single piece of guano and macerated it in peroxide of hydrogen for several days. The peroxide dissolves the oxidized and concreted mucus which holds the mass of guano together. I then filtered this through ordinary filter paper the weight of which I had previously ascertained, and found the residuum to contain principally the comminuted skeletons of mosquitoes; the proboscis, the heads, eyes, thoraces, abdomens, legs, wings and scales of mosquitoes. The external body or shell of mosquitoes being of a horny substance known as chitin, affords the bat no nutrition, being entirely insoluble, hence passes through the alimentary canal as fecal debris. The contents of the head and in fact all internal organs are digested. The weight of this filtered residue of one bat dropping, was approximately 1/25 of a grain*

This much of the work is purely scientific, but it demonstrates the enormous value of these usually despised creatures. I was content with having done this much, and would have considered the work concluded, had it not occurred to me to weigh the twenty-six pieces of guano.

Twenty-six pieces of guano toward the end of the season, when insect life is at a minimum, weigh two and three-fifths grains; the bat in this climate is active from about Feb. 16 to as late as Dec. 15, depending on the season.

In order to be very conservative in estimating the value of the guano, we will calculate only on eight months, namely from the middle of March to the middle of December.

COMMERCIAL VALUE OF ONE BAT ROOST AT ESTIMATED CAPACITY OF 500,000 BATS.

Twenty-six pieces of guano, which are the droppings of one bat per day, weigh two and three-fifths (2 3/5) grains, which equals seventy-eight (78) grains per month, or, six hundred and twenty-four (624) grains per bat in

* Basing his calculations on the analyses of one hundred dried mosquitoes, the writer comes to the conclusion that each of the droppings of a bat contains the skeletal remains of ten mosquitoes, and as a bat drops upwards of 50 pieces of guano a day he considers the number of mosquitoes destroyed by each bat to be above 500 per diem. He further assumes that there are at least five hundred thousand bats per roost.

eight months. 500,000 bats drop in the same time 624 times 500,000= 312,000,000 grains, or more than 20¼ tons; at 30·00 dollars per ton, equals $607·50. A structure large enough to hold 500,000 bats would cost, figuring long, about $ 1,200; now let us treat this estimate just as we did the hygienic, deduct 50 % ; I think we could well afford to deduct 50 % again from that, and still leave a nice margin of income, on the investment.

In the beginning of this writing, it suggested that the bat ought to be provided with a home, in order that we might take advantage of its wonderful habits, and the photograph shown and marked "Dr. Campbell's Hygiostatic Guano-Producing Bat Roost" represents such a structure in actual existence—though intended only as a working model for demonstration. It has proved itself more than a model. The Roost stands ten feet above the ground, and the structure itself, twenty feet above that, is twelve feet at the base, and six at the apex. It is given that steeple shape, and placed above ground for several reasons: its shape makes it resistant to high winds and the elevation from the ground acts as a wind break, and allows the supporting posts to be fitted with contrivances to prevent the bat's enemies from gaining access to the Roost, also a wagon to be driven underneath at the base, which is provided with a hopper on hinges and which opens downward, enabling the guano to be easily collected.

The defence which this structure affords the bat from its natural enemies is of great importance. These enemies are coons (*Procyon lotor*), opossums, wild-cats, skunks, civet-cats (*Viverra civetta*) and chicken snakes (*Coluber quadrivittatus*). It is during the breeding season that the bat suffers most from its natural enemies. Shortly after the young are born, they cling mechanically to the mother's body, and very often loosen their hold, and fall to the bottom of the cave, only to become a prey to some of the aforementioned wild animals, who seek bat caves at this particular season. The mother bat darts down after her young and she also falls a victim to that most noble of characteristics, maternal instinct. These features of protection, and freedom from molestation, will cause the bats to increase so rapidly, that the capacity of the Roost will be soon taxed, especially if it be erected in some quiet place, some distance from human habitations.

This bat Roost I erected at the head of a large body of standing water, ten miles south of the city of San Antonio. The inner construction (which is of course the most vital) is based on lines, after long and most careful study, entirely in harmony with their most singular habits. The louvered window seen on the outside forms the entrance and exit for the bats. A red cross on the apex of the roof designates it as a hygienic measure. In choosing the location for the erection of this Roost, it might be well to mention that it was selected because conditions and environments in the vicinity of its location could not be more ideal for the breeding of mosquitoes. Into this large body of water, known as Mitchell's Lake, flows the sewage of San Antonio, averaging 10,000,000 gallons per day. The extent of territory covered by this lake is estimated by its owners at 900 acres. It never overflows, as the water is used for irrigation, some by gravity, and some by pumping. The huge amount of organic matter in the water, the large pools formed both by irrigation on the land, and water left in the laterals, the receding water in the lake left when used largely, the large pools formed by seepage through earthen dams, outside of the main body of the lake, are the existing conditions, and I am sure that no more exacting demands could be put to the value of bats as destroyers of mosquitoes than such environments. No swamp in the low lands is worse.

The Roost was finished on April 2, 1911. Before locking the louvre, I sprayed the inside with a chemical fluid giving off an odour identical to the natural odour of the bat, and spread twenty-five pounds of fresh guano, in the hopper at the bottom of the Roost.

On August 4, 1911, or about four months later, it became tenanted by a colony of bats attracted there by the odour, that I estimated at several hundred, from the fact that it took them, flying in one constant stream, fully twenty minutes. The next year, 1912, the Roost became so thickly stocked, that it took them several hours to come out; they came out in clouds. This feature conclusively demonstrates the fact that bats can be colonized. There are other features employed in the colonization of these creatures, and these require time and labour, but one is amply rewarded in the end.

When these little "bird animals" once become accustomed to a place, they never leave it except at night to feed and always return in the morning. During the spring of 1910 and 1911, in studying the period of gestation in bats, I had occasion to catch a great many from an old building, and as I could only use the females, I marked every male bat by cutting a tiny "v" on the right ear, and liberating them from my work room, some three miles from the old building. In a week's time, when I again caught a large number from the same place, I would invariably catch some of the same ones again; and in many instances, for the third time, evidenced by the different markings.

It might be said that this vicinity is better favoured for the cultivation of bats than others. The answer is very simple. Of course there are more bats in the neighbourhood of hills and mountains, than in low lands and swamps, because caves are their normal homes, and these are found in hilly and mountainous regions, but the fact remains that they can be colonized, and on just such a territory as desired. There are bats in every city, town or village in the world, because the geographical range of that creature, whether of one species or another, like its principal food, extends from Alaska to Patagonia on this hemisphere, and the same holds good on the other half of the world. The Roost must be built, as said before, entirely in harmony with their habits, or it will prove a failure, as I know from actual experience in building the first Roost.

THE PRACTICAL HYGIENIC AND COMMERCIAL RESULTS.

A few days ago I made a personal canvas of every family living on the east side of the lake. I spoke to the heads of 14 families, and each one declared to me that the mosquitoes last year were very much less than the year before. They also declared that chills had almost vanished. To a man they had become friends of the bat, and they instructed their children never to kill one.

One of the more prosperous tenants pointed out to me a sleek looking herd of work animals as the best evidence of the scarcity of mosquitoes; he said that during 1910 and 1911 his stock was very thin notwithstanding being well fed, and he was certain the emaciation was due to anæmia caused by depletion on the part of the mosquitoes. Several others said that in the same years they were at times driven from the work of irrigating at night by the myriads of mosquitoes on the lake. Last year, 1912, they scarcely bothered them.

One of the tenants said he had often awakened at night, and found what he thought were hundreds of bats flying about in his cottage, all doors being open on account of the heat; knowing them to be in quest of mosquitoes, he never molested them, neither did the mosquitoes molest him, after the bats left. A prominent San Antonio business man, who frequently goes duck-hunting on this lake was very much surprised last year, when he found he was not molested by mosquitoes when remaining in the blinds rather late towards evening in quest of game.

As it becomes essentially necessary that these creatures be not disturbed for some time after finding a new home, I did not go very near the Roost, nor allow any one within the enclosed area. On December 18, 1912, after a

cold snap, I opened the Roost for the first time, and found between four and five hundred pounds of guano had accumulated in the hopper. A sample shows the following chemical analysis:—

Moisture	10·70	per cent.
Water soluble phosphoric acid	1·00	,,
Citrate soluble phosphoric acid	0·35	,,
Citrate insoluble phosphoric acid	0·10	,,
Total phosphoric acid	1·45	,,
Available phosphoric acid	1·35	,,
Nitrogen	11·76	,,
Ammonia	14·26	,,
Potash	0·98	,,

As to bats and guano as a commercial proposition, I quote a letter from Mr. Robert P. Marbach, Broken, Texas, who deals in guano :

" I work two bat caves, one 19 miles from Sabinal on the South Pacific Rail-road, the other 7 miles from here (Bracken). They are known as the Frio cave and the Cibolo cave. The Frio cave is very large and yields about 60 tons annually, but I lose about 20 tons on account of its enormous size and colossal boulders, which prevent gathering all of the deposit. The Cibolo cave yields on an average seventy-five tons annually; it is much smaller than the Frio cave, but the bats are not so scattered, and I have a smaller area to work. I have however the same trouble in this cave that I do in the other, viz., large rocks which prevent me from gathering the entire deposit. I calculate that I lose in this cave about one car-load. However in a wet year, when all water holes are full, and there is plenty of water, I count on a heavy car-load more from each cave.

" This business was handed down to me by my father, who controlled it for many years. I am supplying his customers, and ship large quantities to Crystal Springs, Jackson and Hazelhurst Miss., though the entire crop of my Cibolo cave I shipped to Laredo, Texas, on account of an extensive onion industry which has developed there. I get thirty dollars a ton for my product —put in sacks of about 100 pounds."

In conclusion and as a resumé of this work, let me again revert to a few facts:

1.—That the mosquito is unquestionably one of man's most formidable enemies, not only "per se" but also by the subtle role he plays in transmitting disease-producing bacteria.

2.—That the mosquito may be considered as a good food for the bat.

3.—That we can build a home for the bat where it will be protected from his enemies, and propagate in countless numbers, at the same time protecting us by improving our hygienic conditions.

4,—That the commercial feature in the propagating of bats will insure its adoption, the hygienic benefits that follow will protect the community in which they are erected, especially the poorer classes who know nothing of the dangers of mosquitoes or the use of screens, and amongst whom we find the most sickness.

5.— That when we propagate this most useful creature, it not only destroys the disease-producing mosquito that serves it as food, but it actually converts that most malevolent of insects into a high grade fertilizer.—

Monthly Bulletin.

PROGRESS REPORT OF THE EXPERIMENT STATION, PERADENIYA.

(*From February 15th to April 15th, 1914*)

Tea.—The yield for the months of February and March was 5,305 lb. green leaf; the price $7\frac{1}{4}$ and $7\frac{1}{2}$ cents per lb.

Plots 146-150 were tipped 7th April. After pruning in December these plots were left with a live-branch which yielded on an average 427 lb. per acre for four months. Two rows in the middle of each plot, 148, 149 and 150 had no live-branches left, and the yield of these is being kept separately from the rest for purposes of comparison.

Cocoa.—Picking was continued up to end of February.

A bulletin is being prepared in which all the figures of the experimental plots will be given for the last two years.

All the plots have been thoroughly pruned, at the cost of Rs. 2·50 per acre. Light pruning of suckers is being continuously carried out.

Coconuts.—All the plots under experiment were manured as usual in February.

In the 10-acre plot of young palms two more trees have been destroyed by red-beetle at the base, where it is very difficult to discover them in time to save the tree.

The beetle-traps laid down according to DR. FRIEDERICHS' system contain larvæ of the black-beetle. These are awaiting the inspection of the Doctor who has now arrived in Ceylon.

Rubber.—The *Tephrosia candida* in the new plantations was cut in March and again in April and mulched to the young plants, which apparently derived much benefit from this mulch throughout the dry weather.

All the young plantations have been kept well disced and mulched.

One of the six-year old rubber trees in the tea (plot 154) suddenly wilted and died after putting out its young leaves. The cause of its death was root disease (*Fomes lignosus*).

Coffee.—Two more coffee pests, the brown bug (*Saissetia hemispherica*) and the mealy bug (*Pseudococcus citri*) have made their appearance on the hybrid coffee bushes round the show plots. These with the green bug (*Coccus viridis*) already established on them make three scale pests. The trees are being kept sprayed with kerosene emulsion, but it is extremely difficult to spray thoroughly under the leaves or to get coolies to pay enough attention to the necessity of thoroughness.

In the Robusta coffee under shade there is practically no sign of any green bug left, the fungus (*Cephalosporium lecanii*) having almost eradicated it.

Vanilla.—Several plants of this planted in November, 1911, have flowered and have been fertilized in the usual way.

Fruit Plots.—The mangosteen seedlings planted in bamboo pots on 20th September, 1913, beyond having put out two leaves, seemed to remain dormant. Eight of these have been planted out in dynamited holes and shaded, to see if they will make a forward movement.

Indian melons which were fruiting well suspended on bamboo trellis, at the approach of the hot weather split to pieces before ripening, rendering them only fit for stewing.

Varieties of melon have again been sown as well as cucumber and this time are being kept well shaded from the time of planting. Varieties of cantaloupe with stouter skins have been ordered from America.

Tomatoes have done remarkably well in the dry season. Sown in beginning of November they fruited end of March, with a large supply of fruits weighing 1 lb. each. Two together weighed 3¼ lb. No single plant has been attacked by the withering disease (*Bacillus solanacearum*) as so many were during the wet season, but a fruit fly made its appearance and caused a few fruits to rot.

These tomatoes have found a ready sale in Kandy at three cents each. Seeds of better varieties have now been sown ready for planting in May.

A nursery of *Telfaria pedata*, a valuable gourd from Zanzibar with oil-bearing seeds, has been sown.

Sorghum.—Plot 20, 1/3rd of an acre sown 10th November, 1913, 1½ ft. by 1½ ft. with Undendible sugar cane Sorghum from America and manured with cattle manure was harvested 6th March, 1914, i.e., 120 days, yielded 177 lb. of grain.

Plot 19 of the same Sorghum sown and harvested at the same time but manured with an artificial mixture of Muriate of Potash, Nitrate of Soda, Sulphate of Ammonia, and ash, yielded 87½ lb. only.

The growth of plot 20 was markedly more rapid and luxurious throughout than plot 19. The poor yields are probably due to the very poor nature of the soil on these plots, to too wide planting (9 in. by 12 in. would be quite wide enough for this variety), to an attack on the underside of the leaves by a yellow aphis at present unidentified, and to the drought.

This variety does not seem well adapted for flour purposes as the husk does not separate easily from the grain as does that of some African Sorghums. It would serve as a good food for horses, cattle and fowls. The dried leaves are readily eaten by cattle.

The Sorghum sent from the Sudan was overcarried and lost by the Steamship Company, but another consignment is on its way and will I hope be sown in June.

Plots 19 and 20 have had 500 lb. per acre of lime broadcasted and ploughed in, to improve the soil. They require draining.

The above experiment demonstrated the value of cattle manure which doubled the crop.

Maize.—Plot 20 1/3rd acre sown with American Hickory King 2 ft. by 2 ft. on 6th November, 1913, and harvested 5th March, 1914, i.e., four months, yielded 746 lb. in the cob.

Same plot, 1/3rd acre in native maize, manured with cattle manure, harvested a month earlier, yielded 788 lb. in the cob.

Plot 19, 1/3rd acre Hickory King sown and harvested as above but manured with the same artificial mixture as for the Sorghum yielded 315 lb. in the cob; and 1/3rd acre with the same mixture in Native Maize 240 lb. of very poor cobs.

Here again the crop cattle-manured doubled that artificially manured. Pigs did a certain amount of damage. The percentage of good cobs was very poor.

All the best cobs have been selected and will be kept for resowing and distribution.

Bananas.—The bananas planted in dynamited holes West Indian fashion, with an artificial mixture, though they have fruited much earlier than those planted in the usual Ceylon manner, are disappointing in the size of the bunches produced, the majority being seven hands and under, when they should have been nine and over from the first plants. This may be due to

the inferior varieties. Suwandel and Alukehel were the earliest varieties. Planted 21st June, 1913, they commenced flowering 15th February, 1914, i.e., eight months.

Camphor.—A still with three boxes was made by the Industrial School at Kandy, and a small amount of camphor has been distilled, for the London Exhibition. Our own boiler having been condemned, it will be necessary to procure another for the distillation of the camphor and oil grass.

Drains.—All drains in the Station have been thoroughly cleaned and roads made up and new side-drains made.

London Exhibition.—The following exhibits have been sent to London from the Experiment Station :—

30 blocks Wickham smoked rubber ...	233	lb.
21 rolls do. do.	195	,,
21 rolls Commercial Co.'s do.	104½	,,
3 bands Wickham crepe from smoked parings	19	,,
	551½	lb.
Amelonado cocoa	25	lb.
Nicaragua do.	20	,,
Forastero do.	23½	,,
Caracas do.	26½	,,
Mixed plantation cocoa	25	,,
	120	,,

Thirty sheaves of paddy.
Three bundles of Sisal fibre.
Three sacks Hevea rubber seed.

Labour.—The labour force has become exceedingly small but an arrangement has now been come to removing the difficulty of recovering the whole of the advance yearly. We shall therefore be able to obtain more coolies in the near future.

Visitors.—36 visitors have been conducted round the Station since the last meeting.

PROGRESS REPORT OF THE EXPERIMENT STATION, MAHA-ILLUPPALAMA

(From February 20th to April 20th, 1914.)

Coconuts.—A twelfth round of picking was made on March 6th. The number of nuts collected was 367 from 104 trees which gives an average of 3·5 nuts per tree.

Of this quantity

In the cultivated area, 94 trees gave 341 nuts, an average of 3·75 nuts per tree.

In the uncultivated area, 10 trees gave 26 nuts, an average of 2·5 nuts per tree.

A thirteenth round of picking was made on April 5th. The number of nuts collected was 558 from 150 trees, which gives an average of 3·75 nuts per tree.

Of this quantity

In the cultivated area, 133 trees gave 505 nuts, an average of 3·75 nuts per tree.

In the uncultivated area, 17 trees gave 53 nuts, an average of 3 nuts per tree.

With regard to copra production, the following figures have been obtained :—

Combined Plots.

Picking.		Break in Nuts.	Rejections.	Copra lb.	Number of Nuts required per candy.
November	...	405	1	160½	1399
December	...	337	1	134½	1390
January	...	504	2	203½	1364
February	...	367	2	163½	1233

Picking	Break.	Rejections.	Copra.	No. of Nuts.	Break.	Rejections.	Copra.	No. of Nuts.
January	452	2	185	1344	52	0	18½	1755
February	341	2	154	1214	26	0	9½	1532

The first consignment of copra—12 cwt. was sent to Colombo and sold on March 17th, 6½ cwt. fetching Rs. 84 per candy and the balance Rs. 74—and Rs. 70—per candy. The former figure was top price at the sale, the market being unfortunately very weak at the time. The broker's report on our copra was as follows :—

" The copra is very well dried, but probably owing to its having been kept some time in your store has lost colour."

Owing to the drought, it has been necessary occasionally to water the two traps for Rhinoceros Beetle which were constructed on January 17th and February 9th.

Insect pests, both of the red and black varieties are conspicuous by their absence at the present time.

The fields have now been brought to a proper state of cultivation, and only require to be disc-harrowed once a month.

Paddy.—On March 26th the harvesting operations were started on the 4-acre trial plots. Satisfactory returns are assured, as the crops, which have not been damaged by fly, pig or elephant, were stacked in favourable weather.

The results will be available for my next report.

Fruits.—The plots of Kew and Mauritius pines have been periodically irrigated and cultivated and the flowering stage has now been reached.

The condition of the plots clearly demonstrates the fact that considerable shade is necessary for the cultivation of pines in this Province if the best results are to be obtained.

The 7-year old citrus trees of various kinds are now bearing for the first time. The fruits are very well developed.

TIN CANS *vs.* POTS FOR SEEDLING PLANTS.

E. V. WILCOX.

It has been long observed in the work of propagation at this Station (Hawaii) that young seedling plants, such as papaia, mango, avocado, Christmas tree, &c., grow more rapidly and with greater vigour in tin cans

than in ordinary florist's pots. A set of experiments was carried out to determine the cause of the difference in growth. It was assumed, as a working hypothesis, that two factors were involved—a difference in evaporation and a possible stimulation due to the tin and solder of the cans.

For the first step two tins and two ordinary flower pots were selected. The cans were $3\frac{3}{4}$ inches in diameter and the pots 5 inches at the top and 3 inches at the bottom. All four containers received the same amount of potting soil by measure, approximately 760 grams. The potting soil was made by mixing three parts of ordinary clay soil, 3 parts of rotted manure and 2 parts of coral sand. It had been sterilised by heat, and in an air-dry state contained about 10 per cent. of moisture. To each container 150 c. c. of water was added, bringing the moisture content up to 30 per cent. Holes were punched in the bottom of the tins and the pots had the usual drainage hole. The cans and pots were weighed once or twice daily, and were brought back to the original weight by the addition of water, every other day at first and later every day.

During a period of 17 days the total loss of water by evaporation from the first can was 200 grams ; from the second can 220 grams ; from the first pot 491 grams ; from the second pot 489 grams. Averaging the loss from the cans and pots, the evaporation from pots was exactly $2\frac{1}{2}$ times greater than that from tins. The soil was not shaken or in any way disturbed during the experiment. For the first few days the loss of water from the pots was three times that from the tin cans. At the end of the experiment it was only twice as great. The difference was thus gradually reduced as the soil became packed, reaching in about 10 days what seemed to be a permanent ratio of 1 to 2. The loss of water shown at each weighing was almost precisely the same for the 2 cans, and the same was true for the pots.

In a well ventilated laboratory room and in a ventilated glass-house the ratio of evaporation from tin cans and pots remained constant, but when exposed directly to the sun in the free air the tins showed a relatively greater increase of evaporation than the pots. This was due to the rapid penetration of heat through the tin. Evaporation was of course greatly affected by the humidity of the air. On a rainy day when the air was saturated with moisture the evaporation was only one-tenth that of the following clear, dry night.

It was soon found that, in order to secure results which were comparable from day to day, it was necessary to bring the soil back to the original moisture content each day. Otherwise, on the second day, the soil on the surface of the pots, as well as that in contact with the sides, becomes much drier than that in the tins, and the evaporation is thereby somewhat checked.

The porosity of flower pots varies greatly. Some of them allow the water to pass through so readily that an efflorescence of soluble salts is formed on the outer side of the pot. In order to compare the rate of evaporation from the exposed upper surface of soil in tins and pots, a pot was heavily coated by dipping in melted paraffin, received the same moisture content as the others and was added to the series. No evaporation could take place through the side of this pot. The ratio of the surface of the soil in the tins and pots was as 1 : 1·5. The evaporation from the paraffined pot was 1·52 times as much as from the tins, which corresponds very closely with the difference in exposed surface. It was to be expected that the difference in evaporation would be greater than the difference in exposed surface, for the reasons that the tins and pots contained the same amount of soil and that, therefore, the greater exposed surface in the pots entailed a relatively still greater proportion of the soil near the surface. In other words the soil in a pot is more exposed to evaporation than even the greater surface area would indicate.

In order to determine the relative amount of evaporation through the side of the pot and from the upper surface of the soil, another pot was added to the series. This pot was covered so as to prevent any evaporation from the upper surface of the soil. During the period of the experiment the sum of the loss from the upper surface of the paraffined pot and through the sides of the covered pot almost exactly equalled the average loss from the untreated pots. The average loss for a period of 3 days from the two untreated pots was 40 grams, and the sum of the loss from the paraffined and covered pots was 39 grams, the covered pot losing 18 grams and the paraffined pot 21 grams. From these figures it is apparent that with the ordinary flower pot 52·3 per cent. of the evaporation takes place from the top and 47·7 per cent. through the side. The area of surface (side and bottom) of each pot in contact with the soil was 17·8 square inches. From these figures and those of total evaporation it was easily calculated that the evaporation from a given area is 3·5 times as fast through a free surface of soil as through the side of the pot. The greater area of the side makes the evaporation from the side almost equal to that from the top.

Young uniform seedlings of a species of Schinus (Christmas tree or Hawaiian holly) were planted in 10 cans of the same size as those used in the above-mentioned experiments with the same quantity of potting soil, and also in 10 pots. Five of the cans and five of the pots were coated with paraffin to eliminate any effect which the containers themselves might have on plant growth. The plants in all the tins and in the paraffined pots received 60 C. C. of water every two days, and the unparaffined pots 120 C. C. Of the latter five pots 2 were very porous while the other 3 were equally porous with those used in the simple evaporation test. The plants were as near uniform as possible at the start. At 2 months of age the plants in the two very porous pots were $3\frac{1}{2}$ inches high, those in the three medium-porous pots $4\frac{1}{2}$ inches, those in paraffined pots $5\frac{1}{4}$ inches, those in paraffined tins $6\frac{1}{4}$ inches, those in untreated tins $7\frac{1}{2}$ inches. The height and vigour of the plants showed a regular series of gradations, increasing in size as the evaporation from the container decreased.

At the age of 2 months 2 plants in untreated pots and 2 in untreated tins were selected for daily weighings. The soil in all 4 containers was brought to a moisture content of 30 per cent. which was maintained by bringing it back daily to the original weight by the addition of water. For comparison the 2 pots and 2 tins from the previous experiment and without plants were added to the series. The loss of water by transpiration was calculated by subtracting the loss in the tins and pots without plants from the loss from the pots and tins with plants. For a period of ten days the total evaporation from the two tins without plants was 90 and 102 grams respectively, and the loss from the two tins with plants 301 and 295 grams showing a transpiration of 211 and 193 grams respectively. For the same period the evaporation from the two pots without plants was 186 and 201 grams, and the total loss from the pots with plants was 304 and 310 grams giving a transpiration of 118 and 109 grams respectively. At this stage of growth, therefore, the greater loss of water by evaporation from the pots was approximately balanced by the greater transpiration by the larger plants in the tins. A careful measurement of the leaf surface was made, indicating the leaf surface of the plants in tins to be 1·6 times greater than that of the plants in pots, while the transpiration was twice as great. The plants in tins were growing more vigorously and were obviously transpiring more water per unit of leaf surface.

During the period of 10 days just mentioned the 4 plants outstripped the rest of the group from which they were selected. They were of the same size at the start, but at the end of the 10 day period the two plants in tins were 3 inches taller than the other 3 plants in tins and the two plants in pots

showed a similar increased growth. This shows the importance of maintaining the optimum moisture content as uniformly as possible. The only advantage enjoyed by the four plants which made the greatest growth consisted in the fact that the original optimum moisture content of the soil was restored each day by adding precisely the amount of water lost by evaporation and transpiration during the preceding 24 hours while the other plants received the same amount of water each day. On humid days this was too much and on dry days it was too little.

The great advantage of using tin cans rather than porous pots seems to rest in the fact that in tins it is easier to maintain a nearly constant moisture content without a rapid drying of the soil about the growing roots. This results in a more rapid and vigorous growth. Since nearly one-half of the evaporation from pots takes place through the side of the pot, the movement of this part of water is necessarily in a horizontal direction. Root growth responds to the direction of the water movement in soil. Therefore, the roots reach the side of the container more quickly and in greater numbers in pots than in tin cans. The difference in this regard is striking in all plants with which we have experimented. For example seedling papaias, grown in pots, show a felted mass of roots on the outer surface of the ball of soil in the pot. After watering the soil rapidly dries by escape of water through the side of the pot, thus leaving the young rootlets too dry. By the shrinkage of the soil away from the side of the pot in drying a space is formed into which the water runs upon the next watering. The roots are thus alternately exposed to the air and submerged in water. In tin cans these conditions do not occur. No water can escape through the tin. The moisture content of the whole ball of soil is uniform and consequently the roots distribute themselves uniformly through the mass.

When used in growing seeding plants tin cans show extensive disintegration within a year. Under the influence of oxygen, the soil solution and plant acids, salts of tin, zinc and iron are formed from the can and solder. The growing tips of rootlets come in contact with the side of the can, and are in position to absorb these mineral salts. Naturally the salts of the tin and zinc in the soil in tin cans must be in extreme dilution. Under these conditions tin and zinc are known to stimulate plant growth to some extent. MICHEELS* found that colloidal tin had a decided stimulating effect on wheat and oats. NAKAMURA† showed that zinc in great dilution was a marked stimulant. Similar results were obtained by SILBERBERG.‡

In the experiments at this Station (Hawaii Agricultural Experiment Station, Honolulu) plants grown in untreated tin cans showed a better colour and a more rapid growth than those in paraffined cans. In the paraffined cans the roots could not come in contact with the tin. Since all other conditions were the same it is necessary to conclude that the substance of the tin can itself exerted a slightly stimulating effect.

For the practical propagator these experiments indicate certain suggestions of considerable value. It is impossible to maintain the moisture content of the soil in porous pots as uniform as in tin cans, at least without watering them three or four times daily. Even then there are lateral movements of water through the side of the pot, which bring the roots to the outside of the ball of soil where the variation in moisture content is greater. In these experiments 5 inch pots containing 760 grams of soil lost about 29 grams of water daily by evaporation, while tin cans holding the same amount of soil lost about 12 grams daily. The loss by transpiration depends of course on the size of the plant. A seedling Christmas tree 10 inches high transpires about

* Rev. Sci. (Paris) 5 ser. 5 (1906) pp. 427-429

† Bul. Col. Agric. Tokyo Imp. Univ. 6 (1904) pp. 147-152.

‡ Bul. Torrey Bot. Club 36 (1909) pp. 480-500.

21 grams. daily, and one 5 inches high about 11 grams. These are average figures. The amount varies according to the humidity. It is obviously important to maintain the moisture content of the soil as nearly as possible at the optimum point. This can be determined approximately by a simple test similar to that on which this bulletin is based. A measuring device for watering may then be used by which approximately the right amount of water can be applied to each plant. In this way much better results will be obtained than by guessing at the amount of water required.

The advantages of tin cans over porous pots are several. Flower pots are expensive in Hawaii since we have no material for manufacturing them and they must therefore be imported. Tin cans of various sizes cost nothing except the trouble of going to the pine-apple canneries for them, where rejected cans may be obtained in almost any quantity. On account of the flaring tops of pots they occupy about 1½ times as much space as tin cans holding the same amount of soil. Pots are easily broken in handling, while tins may be roughly handled without injury. The root development of plants is better in tin cans than in pots. The growth of plants in tins is faster than in pots, for the reason that a uniform moisture content is more easily maintained in tins. We find in practice that plants in tin cans will thrive when watered only every third day, under conditions where plants in pots require watering every day. This brings about an economy in the cost of watering. Finally there is a slight stimulating effect from the disintegrating wall of the tin can.—Press Bulletin No. 41, Hawaii Agricultural Experiment Station, Honolulu.

EXPERIMENT STATIONS AND RESEARCH.

The conditions developed by several of the recent changes in the United States illustrate the results of loose organization and lack of a sufficient measure of formality in the management of the experiment stations. They emphasize the difficulty and embarrassment into which a station may be thrown by the retirement or withdrawal of the director unless there has been some systematic and orderly provision for records of the various lines of activities, the plan for financing these, the development of new lines, and an outline of general policy.

The station is to be looked upon as a permanent institution. It has its own funds, and it should have a definite aim, a programme, and a policy. It is composed of a group of men working, not individually, but collectively and unitedly, as an organized body. It should suffer as little shock and setback as possible by a change in directorship; and provision to guard against this should be made from day to day and from month to month, recognizing the permanence of the institution and the liability of change. Such provision is a part of good administration.

The director of an experiment station is not merely the administrative officer but he is the natural leader, and as such is the most fundamental factor in building a strong institution. His personality and viewpoint will have very much to do with the zeal and enthusiasm of the men and the general effectiveness of the station. But its strength cannot rest alone upon his individuality if it is to be more than a one-man station and have permanence. A leader in any line who so organizes his enterprise that it all centers in him and carries the plan in his own mind cannot be regarded as an efficient organizer, but builds only a house of cards. The whole enterprise collapses or is thrown into confusion when he leaves out, and permanence and continuity are only preserved with great difficulty. It is one of the tests of a director that he builds something which will endure, develops

and puts into operation a plan, establishes an ideal, disseminates an inspiration, a sentiment and an attitude, which will remain an invaluable legacy when he has gone elsewhere. In this way he stamps his individuality and his influence, and at the same time leaves a system which is a permanent strength.

Perhaps it is because there has been so much pressure for the immediate result, and the eyes of the men have been kept so largely on the present, that more attention has not been given to the future of the institution, and this may account for a lack of adequate records noticed too often in the administrative office; but it is faulty administration regardless of the cause, and some day the results of it may largely obliterate the good which an officer has done.

To some men system and order are naturally distasteful, and mean to them only "red-tape" and a species of restriction and control which goes counter to their ideas of academic freedom. They pride themselves on not acting according to rule, and assume for themselves a freedom from formality which in the end is dangerous. If such men are placed in administrative positions they should, for their own protection, be surrounded by a system of procedure which will insure an orderly conduct of the station's affairs and provide records for the future.

The growth of the stations in available funds makes necessary a more formal plan of administration than was required when the funds were much smaller. The simple and rather free system then in practice does not meer the needs of the more complicated situation at present, with relatively large amounts of money, more diverse activities and responsibilities, and broader relationships. The desire to keep the system simple and avoid formality has in some cases prevented the organization growing with the funds and left it inadequate.

One of the first things we should expect to find in every director's office, for example, is a complete list of the activities of the station in its various departments, with estimates of their probable needs and the provision made for meeting these needs In fact, it is difficult to see how a station can be intelligently and safely operated without such a record, or how a governing board can be satisfied to authorize lines of work and expenditures. But even at this day such a programme is not infrequently lacking, as some of the recent changes have shown. It has more than once transpired that the Adams fund projects were the only activities definitely listed by the station, and there have been even cases where reference has had to be made to this Office for a list of these lines of investigation. The outlining of all work in the form of projects is becoming far more common in the better organized stations, and is found mutually advantageous to the director and specialists. It is the simplest way of keeping track of what is in progress and what needs to be provided for, and it is a convenience in planning the season's campaign, in following up the work, and in preparing reports. Such an outline ought to be a condition of allotment of funds among departments.

The outlining of plans for experiments and investigations gives opportunity for weighing their importance and for scrutinizing the plan of individual undertakings. There is need for this. It is quite clear that if some of the experiments going on to-day had to be outlined as projects and passed upon by a discriminating director, they would not be undertaken or continued at this stage of station development, but would be turned over to the extension department; and it is equally certain that if there were a critical review or revision of lines which are going on year after year, because they have got in running order and require little attention, there would be a discontinuance or bringing to a head of many activities which are expensive of land, time, and labour, and are not in harmony with the present view or spirit of station work. Some experiments gain in value by long continuation,

if carefully conducted and studied with discrimination in the light of what has gone before; but in other cases these long-continued experiments without change of plan become cumulative evidence of their inability to contribute to understanding. The latter class, instead of being entitled to the veneration of age, should long ago have given way to a search for more effective methods and more productive studies.

Much of the work in the field and the feed lot has reached a stage where it calls for critical analysis and segregation. Now that the line is being more sharply drawn between the acquisition of new knowledge and the dissemination of current information is just the time for the exercise of such discrimination—for making the station work more objective and original and purposeful, and directed at a broader understanding both of the results and of conditions.

The planning and arranging for this is an administrative problem. It calls for a definition of policy, and a weighing of the various types of work in the light of twenty-five years of experience. To a certain extent it calls for a more active direction. Like the carrying out of any programme, it implies some degree of restriction in the freedom of individual action. Experience has shown the importance and reasonableness of this. Especially in the case of the more immature workers, supervision and control are necessary. It is doubtful wisdom to invest a man with "academic freedom" to conduct a long and expensive series of field experiments until it is certain that he has availed himself of what others have done before him, and has developed a method of attack adapted to the case and capable of yielding results of scientific accuracy.

The economical and effective use of the funds of a station require discretion in the selection of topics to be studied, care in planning these studies, and the following up of the work as it progresses. In these respects our station work in some instances leaves opportunity for improvement, and the administrative management lacks the strength which the present magnitude of the enterprise calls for.

In his recent presidential address before the agricultural section of the British Association, PROF. T. B. WOOD, of the University of Cambridge, voiced many of the views which have often been urged in this country as to the basis of progress in agricultural investigation and its application. His address dealt in a general way with the result of the last twenty years, discussing both successes and failures as a guide to the future.

Considering the common field and plat experiments, PROFESSOR WOOD argued for more painstaking methods, to reduce the probable error and make the practical recommendations more reliable and safe. In this country we have recognized the necessity of this, have bent our energies towards safeguarding the results of this type of experimenting, and as time has gone by have realized more and more its limitations. *The safe interpretation of results is the crucial point in experimental work, and this refers back to the manner in which the results were obtained.* Unless the conditions of the experiment are known and the variable factors controlled or checked, there can be no safe tracing of relationship between cause and effect.

Although the number of plats has been multiplied and various checks provided, many of our field experiments are still crude and far from giving results of scientific accuracy. They have served to furnish indications of practical importance, but after twenty-five years of experimenting, which has been so largely on a practical basis, it would seem that many of the practical and commercial aspects of such questions as varieties, culture, feeding, etc., should have received sufficient attention for the present, or at least have indicated the inability of the methods used to settle these questions with a degree of finality and understanding.

Our experimental work has been quite largely the development of facts and the attempt to interpret these in action—in rules or theories largely of

empirical nature. To make this work virile and give it the force of understanding requires a deeper insight than is usually had into the meaning of the facts, the reasons for them, their limitations, and their consequences. It is far easier to develop a body of facts than it is to evolve from those facts a few deductions that are scientifically sound and explained in their relationships and consequences. The latter gives us a working knowledge upon which other knowledge can be built. In this way human intelligence is broadened, since "to know a thing and know you know it, that is knowledge" and this intelligence born of understanding gives power in dealing with the composite phenomena surrounding agricultural operations.

Now that a separate department has taken over the demonstration features, the stations should give their attention to perfecting their experimental work and putting the questions of agriculture in such form that results of scientific accuracy and value will follow. Unless the methods of research in some phases of agriculture can be mastered more effectually, neither the theory nor the practice can be permanently advanced on the basis of scientific understanding.

As PROFESSOR WOOD well said, "agricultural science has now reached that stage of development at which the obvious facts which can be demonstrated without considerable effort have been demonstrated, and further knowledge can only be acquired by the expenditure of continually increasing effort. In fact, the law of diminishing returns holds here as elsewhere."

Responsibility to the farmer and the need of being sure of conclusions is greater than ever, for his confidence has been won and he is in a receptive condition. As PROFESSOR WOOD put it: "The chief danger seems to be that he tries new things simply because they are new, and he may be disappointed if those who are responsible for the new things in question have not taken pains to ascertain with certainty that they are not only new but good . . . . Let us therefore recognize that the farmers of the country are ready to listen to us and to try our recommendations, and let that very fact bring home to us a sense of our responsibility. All that is new is not therefore necessarily good. Before we recommend a new thing let us take pains to assure ourselves of its goodness. To do so we must find not only that the new thing produces a greater return per acre but that the increased return is worth more than it costs to produce, and we must also define the area or the type of soil to which this result is applicable."

In summing up what he terms "the moral of the last twenty years of work in agricultural science," PROFESSOR WOOD says: "The many practical field and feeding tests carried out all over the country have demonstrated several very striking results, but if they are to be continued with profit more trouble must be taken to insure accuracy. Farmers are ready to listen. It behoves us more than ever to found what we tell them on accurate results. Besides such practical trials, however, much has been done in the way of individual scientific work," and he makes an argument for more work of this character, which he declares to be "of practical value to the farmer, as immediate as the most practical field trial, and of far wider application."

This is the keynote of the whole argument for research in agriculture—its practical and its wide application. Results of the most simple trials which are not accurate or cannot be safely extended to similar areas are impractical in the highest sense unless carefully guarded. Unless the findings are accurate and represent the truth as far as they go, they are of little practical or theoretical value but are rather a stumbling block at a stage when mistakes are less excusable than formerly. Unless our work can be progressive in method and in kind it becomes itself a just and valid criticism of our institutions.

No work is of more practical or intrinsic value than that based on research related to practical agricultural questions. The difference between research and the simpler forms of experimenting is one of method and aim,

and not one of subject. The immediate relation of research to practice is limited only by the skill and success of the investigator. If the experiment stops with ascertaining merely the empirical fact and without an attempt to work out the reason on which these facts rest or their limitations, it cannot be regarded as a very high type of experiment and cannot broaden human intelligence, which after all is the ultimate object of all our agricultural experimenting and investigating. There are distinct limits to the working out of rules for practice, to be followed unthinkingly and without consideration of many conditions. The broader understanding essential to intelligent management must rest on well-considered and well-directed research, which goes beyond the realm of human experience and attempts to add something new or a link in a chain of evidence or a new point of view.

The essentials of research were recently outlined in an address by Prof. R. D. Carmichael, published in Science, * in a manner which helps to clarify this subject. "True research," he says, "consists in any one or more of three kinds of work of equal rank, as follows:—

"1. Ascertaining new facts of a permanent character or drawing attention to new relations among facts already known. This requires the power to direct attention to things which other people have overlooked, to separate them from the mass of facts in which they are imbedded, and to study them first for their own sake and then in relation to other things. . . .

"2. Deriving the consequences of facts already known. No fact is thoroughly understood until all its consequences are brought into review or the possibility of doing this has been clearly and definitely recognized. Indeed it is only when this has been done that we can be said to have ascertained that the thing is a fact.

"3. Developing a body of theoretical doctrine, with or without reference to facts to be accounted for by it. Under this head come such matters as the Mendelian theory of inheritance, the electron theory, the mathematical theory of electricity, projective geometry."

As to the subject matter, he says: "Out of the myriads of facts in the universe selection must be made. Some are irrelevant; and these should be discarded. To determine the number of springs of grass on the campus or to count the lady bugs on our planet is not research. These facts—though facts they are—have no permanent character; they do not lead anywhere." And as to the spirit of research he says: "To do effective research is to know the spirit of mastery, the spirit of mastery where no one else suffers the pang of defeat. It is to develop the sense of superiority of mind over that which is not mind. It is consciously to obey the command to subdue the earth. It is to replenish it with a new creation. It is to make the universe a little fuller and richer by understanding it better."

Years ago the director of one of our oldest stations explained in his first annual report that "to rightfully connect cause and effect requires careful education and training of the faculties, and to interpret fully facts in their proper relations requires most considerate study."

In the past few years a long list of efficient station workers have exemplified the meaning of research and its method, have demonstrated its spirit, and have furnished results which show more conclusively than words can the practical and the enduring value of that type of activity. The stage has been reached for its broader application to the live practical problems of agriculture. We have outgrown the more superficial methods and tentative results. It was interesting to hear the statement recently of a station director in the far West, that the most practical and valuable features of his station's activities had been the product of its Adams fund projects;—this in a country where cultivated agriculture is new and where the natural tendency would be for quick results, to answer the questions of the immediate present.

* Science, n. ser. 37 (1913), No. 959, pp. 738-743.

Until permanent and enduring facts are developed we can have only a shifting and uncertain foundation for a theory of practical agriculture; and until our understanding is clear and sure it is impossible to broaden the understanding and the reasoning basis of the farmer.—EXPERIMENT STATION RECORD.

INDIAN CONDIMENTS.

Amongst the many commodities handled by the grocer, few have increased in popular favour during the last twenty years at a greater rate than Indian Chutneys and Curry Powder, the demand for which in this country was no doubt originated by those of our fellow countrymen who had retired to their native land after years of service in our Eastern Empire, and having acquired a taste for these Eastern luxuries, brought home with them supplies and initiated the demand which has gradually spread until both these articles are now recognised leading lines in the stock of the grocer.

The foundation of all Indian Chutney is the mango fruit, which is treated in various ways, being made up into some thirty well-known and well-defined varieties of Chutney—some consisting principally of slices of mango, others being of a pulpy nature, that is, the mango ground up. The manufacturer, however, in preparing his Chutney, uses many other fruits besides the mango, but, whatever kind of Chutney he is making, the mango forms the base, as it were, other fruits being added to give the particular flavour required according to recipe.

Up to about twenty-five years ago the importation of Chutney in original packages was limited, and the sale was confined in this country to very small bottles, sold at what seems to us now ridiculously high prices. However, since that time modern business methods have been applied to this industry, with the result that, at the present moment, the large quart bottle of Chutney which is so familiar to us all can be retailed at the same price as, or lower than, a quart bottle of pickles; whilst it cannot be denied from a "cold meat" point of view that the Indian mango Chutney is quite as appetising as any kind of pickles. Chutney has the further advantage of acting as a digestive agent.

Chutney is shipped to this country principally from Bombay, Calcutta, and Madras, and it is well to bear in mind that these places represent three distinctive methods of preparing Chutney. By far the greater proportion of Indian Chutney imported into this country is shipped from Bombay, in which city are situated some of the largest manufactories of this condiment, owing their popularity undoubtedly to the fact that they are both "good and cheap." Generally speaking, the Bombay manufacturers make two grades of Chutney—a cheap kind and a higher grade article—and although Bombay Chutneys are regarded as not quite up to the same quality as those manufactured in Calcutta, yet these higher grade kinds are quite equal to Calcutta make and have the additional advantage of being able to be retailed at about half the price.

The great demand is, however, for the popular cheap varieties, which are about seven in number, and perhaps here we had better give a short description of some of the well-known kinds. Care should be taken, however, by the grocer to discriminate, otherwise the customer who is looking for a sweet Chutney may be supplied with a sour one, and this sometimes gives rise to serious complaints. The following descriptions should be helpful in avoiding any contretemps.

First and foremost amongst these is the Sweet-Sliced Mango, which is a sweet Chutney containing bold slices of mango fruit, and is medium hot in character. This kind is the best "seller" and the most in demand by the general public.

Bengal Hot is a hot pungent Chutney ground into a pulp and quite free from slices.

Mild Mango is similar in character to the sweet-sliced mango, only, as its name implies, it is not hot.

Green Mango is a sliced Chutney, unsweetened and moderately hot.

Cashmere.—A mixture of sliced and pulp mangoes, sour and very hot.

Tamarind.—A sweet ground Chutney, with tamarind flavour.

Madras.—Another ground Chutney, moderately hot in character.

Besides the above cheap varieties there are the higher grade Chutneys referred to before; these are manufactured from selected mangoes and prepared with a great number of ingredients, the mango slices being more tender than those used in the cheaper varieties, and the Chutneys are milder and sweeter in character.

The following description of a few of the leading kinds may interest the reader:—

Extra Sweet-Sliced Mango.—A delicious sweetened Chutney, containing tender slices of mango fruit, flavoured with spices, and moderately hot.

"Colonel Skinner" Chutney.—A mixture of mangoes and other fruits cut into slices. Medium hot and prepared from an old original recipe.

"Major Grey."— A sweet mild Chutney of a sweet pickle character.

Bengal Club.— A real fruity pulp Chutney of a very mild nature.

Sweet Lucknow.— A mild sweet Chutney with a great variety of fruits blended with mango slices.

Tirhoot.— A very high-class sweet-sliced mango Chutney, moderately hot, but prepared with the choicest mango slices and selected spices.

The names of the above varieties are applied to standard kinds of Chutney, each made up on a specific recipe, which necessitates only the highest quality ingredients being used. Unfortunately there has been a tendency by some importers to use these names indiscriminately, and to label as "Tirhoot" and "Colonel Skinner" a very cheap variety of Chutney. It is well, therefore, to remember that it is impossible to get amongst the cheap varieties, a real "Tirhoot," or a real "Colonel Skinner," and that any offered as such must of necessity be imitations.

Calcutta Chutneys are similar in character to the best Bombay kinds, and are perhaps rightly regarded as of superior quality; certainly they fetch a very much higher price and, being made from selected and rich-flavoured mangoes, they are generally milder and very fruity in character, but, as before explained, the sale of Calcutta Chutney, is very limited owing to the high price demanded.

Madras Chutneys differ considerably from both the Bombay and Calcutta kinds, and although the names of the varieties are similar to those used in Bombay and Calcutta, the chutneys are themselves of a very different nature, the most part having the appearance of a sticky mixture, which is at the same time extremely hot and pungent. The demand for these Chutneys is confined almost entirely to people who have lived in the East, and they are not likely ever to become a popular kind in this country.

Madras, however, is more celebrated for its Curry Powder, and its leading manufacturer (Mr. P. VENCATACHELLUM) is well-known throughout all the world. It is the excellence of his Curry Powder that has enabled the cooks and chefs in different parts of the world to make curries similar to the famous native curries made in India. The native chef is renowned for the excellence of his curry, and of course enjoys the advantage of making this with fresh spices, and it says, therefore, a great deal for P. VENCATACHELLUM'S Curry Powder that in capable hands it can rival the best efforts of the native chef.

Each manufacturer has his own particular method of preparing Curry Powder, and each no doubt has his secret formula, but in the main it is

composed of the following:—Turmeric, Coriander Seeds, Cardamoms, Mace, Cinnamon, and similar spices. These are all ground and blended together in certain proportions. Madras Curry Powder is usually packed in 1 lb. and ½ lb. tins, although large quantities are also shipped in bulk and repacked into bottles of various sizes.

The term "Indian Condiments" includes other articles besides Chutney and Curry Powder, although the demand for these is, comparatively speaking, limited; but manufacturers make some very good Indian Pickles packed both in oil and in vinegar—of these the Lime Pickle, Mango Pickle, and Brinjal Pickle are the most popular.

Another popular line is Bombay Ducks, which is not a duck at all, but, strange as it may seem, is a dried fish (sometimes called "Bummaloe Fish"), which is appreciated by Anglo-Indians, although its somewhat strenuous aroma is quite enough to keep off ordinary mortals.

Poppadoms.—These are a dry, thin, paper-like biscuit which is used for eating with the said Bombay Ducks.

Although it can hardly be described as a condiment, a favourite article imported from India with these goods is Guava Jelly, a delicious jelly made from the guava fruit, the demand for which is growing very steadily in this country.

There are other articles which might come under the description of Indian Condiments, but the demand for them being only limited, one has endeavoured to devote the time and space allotted to this subject to those lines which are in more general daily demand.—GROCERS' JOURNAL.

A NEW COVER-CROP.

(*DOLICHOS HOSEI*)

BY W. G. CRAIB.

Last year MR. E. HOSE* drew attention to a cover crop which had proved highly satisfactory with him in Sarawak. In the same article there was an editorial note to the effect that MR. HOSE had sent cuttings which would be tried in the Kuala Lumpur Experimental Plantation. In response to an inquiry from Kew the Director of Agriculture, Kuala Lumpur, forwarded specimens for identification. The specimens could not be matched in the Kew herbarium, and as they did not appear to agree with any described species of *Dolichos* they have been made the type of a new species—D. HOSEI—named after the discoverer.

In the course of his article quoted above, MR. HOSE says that for five years he has been experimenting with various leguminous plants as cover crops. His experience demonstrated to him that what was required was a low-growing leguminous plant which could be dug into the soil and which would reproduce itself in time to check the growth of weeds. For three years he had been planting D. HOSEI with rubber and had then 200 acres planted with it—the result being that it had "proved itself in every way a success." He describes the plant, which he says is indigenous in Sarawak, as forming a thick level mass about six inches thick on the ground; it will grow on almost any soil, but a light one for preference, and in six months after planting should prevent all wash, if planted three feet apart. The trees, he adds, are ring-weeded monthly. It "grows readly from cuttings but seeds are difficult to procure," a fact which has been corroborated during the Kuala Lumpur experiments.

*Notes on a Creeping Bean—AGRIC. BULL. Fed. Mal. States, vol. i. p. 276.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

	QUALITY.	Quotations.
ALOES, Socotrine cwt.	Fair to fine	40/ a 50/
Zanzibar & Hepatic ,,	Common to good	40/ a 70/
ARROWROOT (Natal) lb.	Fair to fine	5d a 5½d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 12/6 a £7 17/6
East Indian, bleached ,,	Fair to good	£8 10/a £8 15/
,, unbleached ,,	Dark to good genuine	£6 5/ a £7
Madagascar ,,	Dark to good palish	£7 15/ a £8 2/6
CAMPHOR, Japan lb.	Refined	1/7 a 1/8
China cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	5/1 a 5/4
per lb.	Middling lean	3/9 a 4/7
Malabar, Tellicherry ,,	Good to fine bold	5/ a 5/3
Calicut ,,	Brownish	3/ a 4/8
Mangalore ,,	Med Brown to good bold	3/ a 5/6
Ceylon, Mysore ,,	Small fair to fine plump	3/3 a 5/9
Malabar ,,	Fair to good	3/ a 3/3
Seeds, E. I & Ceylon ,,	Fair to good	3/9 a 4/
Ceylon "Long Wild" ,,	Shelly to good	2/3 a 3/6 nom.
CASTOR OIL, Calcutta ,,	Good 2nds	3¼d a 3⅜d
CHILLIES, Zanzibar cwt.	Dull to fine bright	45/ a 50/
Japan ,,	Fair bright small	50/
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7 d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾ d a 4½d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/7
per lb. 2nds.	,, ,,	1/2 a 1/6
3rds.	,, ,,	1/1 a 1/5
4ths.	,, ,,	1/ a 1/3
Chips.	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	1/ a 1/2
Amboyna ,,	Dull to fine	10d a 10½d
Zanzibar ,,	Fair and fine bright	5¾d a 6d
Madagascar ,,	Fair	7d
Stems ,,	Fair	2d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	63/ a 80/
COCOA, Ceylon Plant. ,,	Special Marks	81/ a 88/6
	Red to good	73/ a 80/6
Native Estate ,,	Ordinary to red	42/ a 68/
Java and Celebes ,,	Small to good red	30s a 93s
COLOMBO ROOT ,,	Middling to good	15/6 a 22/6
CROTON SEEDS, sifted,,	Dull to fair	42/6 a 47/6
CUBEBS ,, ,,	Ord. stalky to good	130/ a 150/
GINGER, Bengal, rough ,,	Fair	19/
Calicut, Cut A ,,	Medium to fine bold	60/ a 75/
B & C ,,	Small and medium	36/ a 60
Cochin, Rough ,,	Common to fine bold	22/6 a 27/
	Small and D's	20/
Japan ,,	Unsplit	20/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 10/ a £7 5
Madagascar ,,	Fair to good palish	£4 a £8
,, ,,	,, ,, red	£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	26/ a 30/
Turkey sorts ,,	,, ,,	32/ a 55/
Ghatti ,,	Sorts to fine pale	18/ a 28/ nom.
Kurrachee ,,	Reddish to good pale	22.6 a 27.6 nom.
Madras ,,	Dark to fine pale	20/ a 27/ nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£6 a £6 10/
	com. stony to good block	40s a £5
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	57/6 a 67/6
Somali ,,	,, ,,	52s 6d a 55s
OLIBANUM, drop ,,	Good to fine white	45s a 50s
,,	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	18s a 25s
INDIA RUBBER lb.	Fine Para smoked sheets	2/5½
	Crepe ordinary to fine	2/5½
Ceylon, Straits, ,,	Fine Block	2/5½
Malay Straits, etc. ,,	Scrap fair to fine	2/ a 2/1
Assam ,,	Plantation	1/11
,,	Fair 11 to ord. red No. 1.	1/6 a 1/7
Rangoon ,,	,, ,, ,,	1/3 a 1/6

	QUALITY.	QUOTATIONS.
INDIA RUBBER lb.		
Borneo ,,	Common to good	9d a 1/4
Java ,,	Good to fine red	1/4 a 1/7
Penang ,,	Low white to prime red	9 d a 1/6
Mozambique ,,	Fair to fine red ball	1/9 a 2/2
,,	Sausage, fair to good	1/9 a 2/1
Nyassaland ,,	Fair to fine ball	1/9 a 2/
Madagascar ,,	Fr to fine pinky & white	1/6 a 1/7
,,	Majunga & blk coated	1/ a 1/2
,,	Niggers, low to good	6d a 1/6
New Guinea ,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E.I. Bengal ,,	Shipping mid to gd. violet	3s 3d a 3s 8d
,,	Consuming mid. to gd.	2s 9d a 3s 2d
,,	Ordinary to middling	2s 4d a 2s 9d
,,	Mid. to good Kurpah	1s 11d a 2s 5d
,,	Low to ordinary	1s 6d a 1s 9d
,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang	Pale reddish to fine	2/4 a 2/6
per lb.	Ordinary to fair	2/ a 2/2
Java	,, ,, good pale	2/1a 2/4
Bombay	Wild	1/
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	9½d a 10½d
	80's	7½d
	110's	6½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20
NUX VOMICA, Cochin	Ordinary to good	13/6 a 15
per cwt. Bengal	,, ,,	12/
Madras	,, ,,	12/ a 13
OIL OF ANISEED lb.	Fair merchantable	5/6
CASSIA ,,	According to analysis	2/10 a 3/2
LEMONGRASS oz.	Good flavour & colour	2⅜d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	3½d a 1s 5d
CITRONELLE lb.	Bright & good flavour	1/5½
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	12/6 nom.
Madagascar ,,	Fair	12/6 ,,
Zanzibar ,,	Fair	12/6 ,,
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5d
Ceylon ,, ,,	Fair to fine bold heavy	5d a 5⅜d
Singapore ...	Fair	4⅞d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore ,,	Fair to fine	8½d a 8¾d
Siam ,,	Fair	8½d
Penang ,,	Fair	7¾d
Muntok ,,	Fair	9d
RHUBARB, Shenzi ,,	Ordinary to good	2/ a 4/
Canton ,,	Ordinary to good	1/10 a 3/6
High Dried,,	Fair to fine flat	11/ a 1/1
	Dark to fair round	9/d a 11d
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ...	,, ,,	16/
small ...	,, ,,	13/ a 14
Flour ...	Good pinky to white	10/ a 11/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 75
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Common specky & small	1¼ d a 2½d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	85/ a £5 15/
Bombay ,,	,, ,,	77/6 a £5 5/
Mergui ,,	Chicken to bold	£9 10 a £14 10
Manilla ,,	Fair to good	£8 a £13 12 6
Banda ,,	Sorts	50/ nom.
Green Snail ,,	Small to large	67/6 a 80
Japan Ear ,,	Trimmed selected small to bold	25/ a £6 17 6
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	14/ a 15
per cwt. Madras	Inferior to good	6/ a 10
TORTOISESHELL—		
Zanzibar & Bombay lb.	Small to bold	14/ a 24
	Pickings	8/6 a 16/6
TURMERIC, Bengal cwt.	Fair	12/ a 13/
Madras ,,	Finger fair to fine bold	14/ a 16 6
Do. ,,	Bulbs ,, ,, [bright	12/ a 13
Cochin ,,	Finger fair	13/ nom
	Bulbs ,,	12/
VANILLOES lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½a in.	9/6 a 15
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	9/ a 12
Seychelles ... 3rds.	Lean and inferior	9/ a 9 6
VERMILLION ... lbs.	Fine, pure, bright	2/8
WAX, Japan, squares cwt.	Good white hard	50/

INDEX.

A.

Agricultural Colleges, The Indian 310
,, Conference, All-India 149
,, Education and Research in Great Britain ... 68
,, Research Institute, Pusa 384
,, Society, Recent Introductions by the ... 168
,, Society's work in Paddy 166
Agriculture, Explosives in ... 33
,, , Radium in 31
Agromyza phaseoli, Coq: 411
Allium triquetrum, A new vegetable from 17
Ambalantota Cotton 505
Ant Repellants 139
Anuradhapura Experiment Station, First Progress Report 83
Artificial Ripening of Cotton ... 374
Awakening on the Amazon, The ... 450

B

Bacillus Radicicola & Preparations for Soil Inoculation 402
Bacterised Peat, Properties of ... 490
Balsam of Peru 334
Banana as a Food, The 348
Banana Cultivation ... 294, 386
,, ,, in Jamaica ... 298
,, Industry, The 385
,, Vinegar, How to make ... 380
Bananas, Handling & Storing of ... 28
,, in Jamaica 40
Baobab Fruits & Seeds in the East African Protectorate 422
Basic Slag as a Manure 317
Bat, Economic Value of the ... 300
Bean Fly 411
Belladonna in India 27
Betel Leaves, Chemistry & Physiology of 66
,, Vine Disease 168
Birds, Value of Wild 324
Blue Orpingtons 217
Bombax malabaricum 201
Borassus flabelliformis 210
Borer of Tea & Coffee 131
Breeding of Egg-laying Poultry ... 310
Brevipalpus obovatus, Donn ... 225
Buffalo Milk 173

C.

Cacao at Peradeniya 21
,, Criollo variety ... 187
,, Fermentation 364
,, Forastero variety ... 187
,, Introduction into Ceylon ... 8
,, Manuring Experiments ... 366
,, Propagation 187
Cactus as Fodder 309
Camphor, Leaf Miner of ... 465
,, Production in India ... 163
Can Selection improve a pure strain of plants ? 237
Canned Pine-apple 363
Cannon-ball Tree 342
Carbon Dioxide & seed vitality ... 337
Cattle Breeding in German East Africa 35
Cedar woods 169
C. A. S. membership ... 169
,, Minutes of Meeting held on 3/2/14 242
C. A. S. Subscription, Rate of ... 84,168
,, Staff, Movements of ... 167
,, Year Book 1913-14 ... 355
C. P. C. Magazine 419
,, Report on the ... 47
Ceylon Poultry Notes 215
Charcoal for Poultry, Value of ... 311
Chicken Pox in Fowls, Cure for ... 216
Chickens and Bees 212
,, , The care of 420
,, Treatment of the Growing 471
Chili Cultivation in America ... 470
Citrus Cultivation, Soils suitable for 117
Citrus ichangensis 393
,, in the Philippines, Cultivation of 291
,, Medica 300
,, Trees, New 393
Clania variegata 465
Clary 242
Coagulation of Hevea latex by smoke 95
Coconut Butter 96,363
Coconut Industry, The Development of the 330
Coconut Planting a profitable enterprise 360
Coconuts at Papua 275
,, in Antigua 454
,, ,, Fiji 5
,, ,, the Philippines and F.M.S. 275
,, ,, Panama 274
,, ,, the Island of Samar 362
,, ,, the Seychelles, Manuring of 4
Coconut Notes 170
Coconuts, Sweet Potatoes as a Cover crop for 362
Coffee and Tea, a borer of .. 131
,, White Ants on ... 96
Coffee & Tea, A borer of ... 131
Coffee at Peradeniya 21
,, in East Africa 34
Coimbatore Conference 487
Conditions affecting Soil Fertility 346
Congress of Tropical Agriculture, Third International ... 160
Consols of the East 273
Co-operation, Good effects of ... 409
Co-operative Credit 441
,, ,, in the United Provinces ... 484
,, ,, Movement Transforming India... 121
Co-operative Credit Societies ... 169
,, ,, ,, Some problems connected with ... 405
Copra 275
,, Increasing value of ... 190
,, The Drying of 190
Cotton 172
,, ,, American Long Staple ... 370
,, Artificial Ripening of ... 374
,, at a Madras Agricultural Station 201
,, ,, Ambalantota 505
,, Blight in Egypt 202
,, Brazilian 371
,, Egyptian 370
,, Experiments at Hambantota 265
,, Peruvian 371

Cotton, Sea Island 369
,, , will American be always Supreme? 12
Cottons of Cultivation 369
Credit and Co-operation and Rural Districts of Ceylon 480
Cryptorhynchus mangifera Fab. ... 410
Cryptothrips floridensis 463
Cultivation and Preparation of Rice 279
,, of Bananas 461
,, ,, Rubber in Brazil ... 179
,, ,, Upland or Hill Rice 193
,, ,, Vegetables and Flowers. 76
Cure for Snake Bite 246

D

Dairy Show, The London ... 128
Date Palm Scales 165
,, ,, , The 388
Decomposition of minerals: Soil Chemistry 347
Desmodium hirtum 32
Destroying Stumps with acids ... 231
Destruction of Rubber by microbes 443
Devices for assisting Fruit Production 263
Discussion 1
Distribution of Manure in Drills ... 398
Dolichos Hosei 527
Drought-resisting Crops... ... 394
Dry Farming 208
,, ,, , A Subsidiary consideration 22
Dry Farming by A. W. Beven 304
,, ,, in Australia ... 24
,, ,, ,, India ... 209
,, ,, : Letter from Mr. D. M. Weigel 25
Dynamite in Farming 59

E.

Earth drying up—Is the? ...253, 428
Egg-laying Competition, South African 211
,, Production for profit ... 124
,, Records for 1912-1913, Irish 68
Elaeis Guineensis 207
Electricity & Plant life 240
,, and Plant Production ... 496
,, in the Service of Horticulture 108
"Electrified" Chickens 130
Elementary Tropical Agriculture (Review) 355
English Vegetable Seeds ... 267
Ensilage 157
Enteritis among Poultry ... 50
Entomology in the United States of America 468
Enzymes of the Tobacco Plant ... 101
Eradication of Mosquitoes by the Cultivation of Bats 508
Eragrostis abyssinica 489
Experiment stations and Research 520
Experiments on the Influence of atmospheric electricity on Plants 451
Experiments with Rice in Tonkin 456
Explosives and Tea Cultivation ... 239
,, in Agriculture ... 3
Exterminating Rats 330

F.

"Farmers' Week" at Cornell ... 147
Ferguson, Late Mr John—Tribute paid by the Board of Agriculture... 57
Fermentation of Cacao 452
Fertiliser, The so called New ... 304
Fertility of Soils 115
,, ,, — Solution of Plant Food 345
Flax culture in Br: East Africa ... 107
Flies, Campaign against ... 504
Fowl Thefts 479
Fruit Cultivation 95
Funtumia elastica in West Africa 93

G.

Gardening and Good Seed ... 495
Gardens for the Poor 338,485
German System of helping Farmers 123
Ghee 272
Grafting the Papaw 392
Green Manure and Weed Preventive, A 32
,, Manures for Paddy ... 278
,, Manuring 71
,, ,, on Clay Soil, effect of 395
Grenier's Rubber Annual ... 92
Groundnuts 340

H.

Hemp Seed, Experiments in Hungary with 439
Hevea in Cochin China 447
Hevea, Leaf Diseases of ... 268
Horses 84
Hyssop and Rue 242
Hyssopus officinalis 242

I.

Incision and Excision methods of Tapping 271
Indian Agricultural Colleges ... 319
,, ,, *World, The* ... 460
,, Condiments 525
Insects injurious to Camphor ... 463
,, on Rubber in 1913 ... 41
Intensive Poultry Keeper's Guide 421
International Rubber Exhibition, offer of Silver Cups 180
Is the Earth Drying up?... ... 253,428

J.

Jamaica—Panama Hats 70
Japanese Landscape Gardens ... 247
Jute Industry of Calcutta ... 322
,, in Lower Burma ... 103

K.

Kainit as a Preventive against White Ants 97
Kapok 170
,, Growing as an Industry 373
"Kroepock" of Tobacco in Kamerun 377

L.

Lac culture 95
Leaf Diseases of Hevea 268
Legumes, The Benefit of ... 55
Lemon Grass in Fiji 202
Licorice, Its uses, &c 332
Lime on Moor Soils 115
Liming Land 72
London Dairy Show 128
,, Rubber Exhibition ... 185
Lucerne at Peradeniya 10
,, Cultivation, &c ... 314
,, from Seed-bed to Market 232

M.

Mahailuppalam Expt. Station ... 515
Maize (Review) 501
,, and Fowls 214
,, Storing 429
,, Sugar 331
Malaria & Tropical Agriculture ... 151
Malayan Agriculture in 1912 ... 156
Mango Weevil 410
Mangoes and Coconuts in Ceylon 186
Mangrove Forests of the Philippines 75
Manihot glaziovii in the Belgian Congo 92
Manures and Soil Fertility ... 109.203
,, the Ripening of Sugar Canes 395
,, , Different Phosphatic ... 32
,, for the Cultivation of Rice. 284
,, , The Choice of 30
Manuring of Coconuts in the Seychelles 4
,, Vegetables and flowers 503
Medicinal Plants in Hungary .. 241
Melissa officinalis 242
Mentha piperita 241
Milk from Soya Beans 116
,, . New Method of Preserving... 51
Minimum of plant Food required for Maximum of Production ... 367
Molassed Superphosphate ... 403
More about Coconuts (Reviews) ... 356

N

Natural Infection of Calves with Tubercle Bacilli 499
Nature Study in Secondary Schools 79
Neutralizing the Pungency of Ginger 145
New Cover Crop 527
,, Method of Tapping Manihot 186
Nipa Palms for Toddy, Tapping of 172
Nuwara Eliya Poultry Show, April 13, 1914 474
Nuwara Eliya Poultry Show, Results 478

O

Oil Palm 207
,, in French Guinea ... 490
,, ,, Malaya, African ... 61
,, ,, Southern Nigeria ... 64
,, Products & the Dry Zone 177
Olive Growing in Italy 39
,, Oil, Output for 1913 ... 274
Onion Growing 219
Origanum majorana 242
Oryctes rhinoceros, L. 229
Oxalis Weed, Experiments to exterminate it at Kumaun ... 29

P.

Paddy-Cultivation & preparation of Rice 195
,, Cultivation in Ceylon ... 89
,, ,, ,, ,, During the 19th Century 98, 286, 381
,, Cultivation in Ceylon, How to improve 276
,, , Green Manures for ... 278
,, ,, Manuring of ... 192
,, in Madras 192
,, Polished Rice ... 18
Palmyra Palm 433
,, ,, in West Africa 210
Papain in Ceylon 167
Papain : Its Production and Uses 73
Peat Plant Food 86
Pepper, Cultivation of, as a minor or subsidiary product in Ceylon 431
Peppermint 241
Peradeniya Expt. Station ... 513
Philippines, Mangrove Forests of the 75
Physiology of the Germination of Rice 455
Pine-apples in Formosa 297
Plant and Seed Supplies to members of C. A. S. 267
Plantation Rubber, Preparation of 181
Planting in Antigua, Notes on ... 507
,, Guatamala ... 100
Plants other than Tea from which *Xyleborus fornicatus* has been taken 307
Pollination & Cross-fertilisation in Rice 44
Poultry, Breeding of egg laying ... 310
,, , Fattening ... 129
,, , Give meat to layers ... 420
,, Keeping in Ceylon ... 418
,, ,, on a small holding 45
,, Notes, Ceylon ... 127
,, , Quality as a Factor in Production ... 414
,, Roup or Contagious catarrh in 313
,, , Scaly Legs in ... 47
,, , Some suggestions ... 479
,, , 320 eggs in 365 days ... 130
,, , Value of Charcoal for ... 311
Preparation of Plantation Rubber 181
Pots vs. Tin Cans for Seedling Plants 516
Prizes at Poultry Shows ... 419
Pots *v.* Tin Cans for Seedling Plants 516
Production of Alcohol for Motor Fuel 492
Products of the Coconut Palm, 1913 exports 360
Professor Wyndham R. Dunstan 154
Progress Report Maha-illuppalama Experiment Station (20/2/14-20/4/14) 515
Progress Report Peradeniya Experiment station (15/2/14-15/4/14) 513
Propagating Date Plants ... 389
Pruning Trees 343

R.

Radium in Agriculture 331
Rainfall and Coffee 505
,, ,, Tobacco ... 101
,, for October, 1913 ... 73
,, ,, November, 1913 ... 73
,, ,, December, 1913 ... 172
,, ,, January, 1914 ... 200
,, ,, February, 1914 ... 189
,, ,, March, 1914 ... 413
,, ,, April, 1914 ... 451
,, ,, May, 1914 ... 453
Rat as a Coconut Pest 359
Rearing Ducks in the Philippines 416
Relation between an abundant Rainfall & the Production of Coffee 505
Research, Experiment & Demonstration ...350, 423
,, in Bengal 331
Rhinoceros Beetle 229
,, ,, , Horn of the ... 231
,, ,, Traps ... 353
Rice, Cultivation & preparation of 279
,, ,, , Climatic Conditions & Soil requirements ... 282

Rice Cultivation in the United States 173
,, Growers' Congress ... 384
,, , Physiology of the Germination of ... 453
,, , Pollination & Cross fertilization in ... 44
,, Production in the British Empire and Egypt. ... 457
,, , Seed Selection in ... 283
,, Soils 462
,, , Talc as a Renovator of damaged 120
Riddle of Species 335
Root Secretion 171
Rotation of Crops 285
Roup or Contagious Catarrh in Poultry 313
Rows in Corn Cobs 253
Rubber—Brazil & Standardization 185
Rubber Crisis, The 184
,, Growing in Java ... 449
,, in Brazil 270
,, ,, ,, Cultivation of ... 179
,, Industry in Uganda ... 183
,, Market, The 183,269
,, , Tapping, Incision and Excision Methods of ... 271
Tapping Manihot, New Method of 186
,, Testing machinery at the Imperial Institute ... 444
,, Thinning out, Criticisms by Mr. G. A. Talbot on views of Ceylon experts 94

S

Sage 242
Salt as a Manure 139
Salvia officinalis 242
Salvia sclaria 242
School Gardening (Review) ... 336
School Gardens 150
Seeding Paddy 192
Seedling Plants, Tin Cans vs. Pots for 516
Seeds dormant under gas ... 272
Seed selection in the Cultivation of Rice 283
Selecting Land in the Tropics ... 243
Selection & Treatment of Cane Cuttings 404
Sericulture Experiments in the Punjab 162
Shot-hole Borer, Some notes on ... 133,220
Siamese Pomelos 297
Silk Cotton Tree 201
Sisal Hemp 372
,, ,, in Fiji 105
,, ,, ,, German East Africa 11
,, ,, ,, Yucatan 12
So-called New fertiliser ... 304
Soil Exhaustion 400
,, Inoculation 396
Some Problems Connected with Co-operative Credit Societies ... 406
Sorghum in Madras 185
Sorghum vulgare 333
Sources of the nitrogen of vegetation 328
Soya Bean, Oil from 275
Stomoxys calcitrans 222
Subsidiary Consideration in Dry Farming, A 22
Sugar Manufacture, Modern method *vs* old 326
Sugar, Value of 241
Superphosphate and Basic Slag, Influence on the state of fineness on their efficiency ... 402
Sweet marjoram 242
Sweet Potato as a cover crop for coconuts 362
,, Potatoes, Planting Tubers *vs* Vines 374

T.

Talc as a Renovator of Damaged Rice 120
Tapping, Incision and Excision methods of 271
,, Manihot, New method of ... 186
Tasmania for the settler ... 3
Tea & Citrus Mites 225
Tea and Coffee, A Borer of ... 131
Tea at Peradeniya 21
,, Cultivation in Ceylon ... 14
Tea, The Selection of 492
Teak Cultivation in Java ... 436
Teff Grass 489
Termites 305
Tetranychus bioculatus, Wood Mason 227
Thinning out Rubber 94
Third International congress of Tropical Agriculture, London, 1914 160
Tin Cans *vs* Pots for Seedling Plants 516
Tobacco, Cigar Wrapper ... 52
,, in South Africa, Turkish 231
,, Manuring Experiments in Hungary 375
,, Plant, Enzymes of the ... 101
,, Prospects 196
,, , Rainfall and 101
,, Stalk as a fertiliser ... 379
,, Warehouse Management 196
Tomato Growing at Peradeniya 57
,, Soils 392
Treatment of the Growing Chickens 471

V.

Value of Wild Birds ... 324
Vegetables and Flowers, Cultivation of 76
Vegetable oil Industry of Marseilles 321
Visitors to the R. B. G. for. Sept: Oct: & Nov: 1913 29

W.

Weeds, Injury done by 123
"Wellcome" Photographic Exposure Record and Diary for 1914 ... 3
What the Rubber Chemists are doing 446
White Wyandotte, The 472
Wickham Hard Cure 448
Will American Cotton always be supreme ? 12
Work of the Scientist 430
World's Cotton Industry ... 368

X

Xyleborus compactus, Eichh ... 131
,, ,, from Camphor 467
,, *fornicatus*—Plants other than tea from which it has been taken 307
,, *fornicatus*, Eichh, some notes on 132,220